DOCUMENT RESUME

ED 181 043 TM 009 922

AUTHOR Fedigan, Larry
TITLE School-Based Elements Related to Achievement: A Review of the Literature.
INSTITUTION Alberta Dept. of Education, Edmonton. Ministers Advisory Committee on Student Achievement.
SPONS AGENCY Alberta Dept. of Education, Edmonton. Planning and Research Branch.
PUB DATE Mar 79
NOTE 119p.; For related documents, see TM 009 921 and TM 010 021

EDRS PRICE MF01/PC05 Plus Postage.
DESCRIPTORS *Academic Achievement; Achievement Gains; *Classroom Observation Techniques; *Classroom Research; Correlation; *Educational Research; *Effective Teaching; Elementary Secondary Education; Evaluation Needs; Foreign Countries; Institutional Characteristics; Predictor Variables; Research Reviews (Publications); Student Characteristics; Student Teacher Relationship; *Success Factors; Teaching Styles; Teaching Techniques
IDENTIFIERS Canada; United States

ABSTRACT

Eight major classroom observation studies correlating process variables (teaching techniques), and context variables (characteristics of school, curriculum, and student), with teaching effectiveness, (particularly achievement gains) were reviewed. This need to match process variables with context variables, rather than search for a universal teaching style was cited. One match has already been defined--traditional teachers in low socioeconomic classrooms appear to be consistently effective. Also, there is a strong subject matter/teaching style relationship in higher grades. Like the process variables, context variables--notably, classroom climate, teacher expectations, ability, socioeconomic status, mastery learning, and individualized instruction--generally have failed to correlate universally with achievement. Results of Canadian teacher effectiveness studies are similar: the most promising developments are taking place at Simon Fraser University, Memorial University and the University of Alberta. Current research is attempting to establish consistent generic relationships and to translate relationships into statements of cause and effect. Because this is necessarily a slow process, conclusions may be limited and tentative. Finally, the separation of educational research variables into school-based and non-school-based domains has considerable academic, political, and economic implications. (CP)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED181043

U S DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

School-Based Elements Related To Achievement: A Review of the Literature

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

W. D. Eddy

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

TM009 922

March 1979

Alberta

Minister's Advisory Committee on Student Achievement

SCHOOL-BASED ELEMENTS RELATED TO ACHIEVEMENT: A REVIEW OF THE LITERATURE

by Larry Fedigan

A Study Commissioned by the

Minister's Advisory Committee on Student Achievement

(MACOSA)

Funded and Administered by

The Planning and Research Branch

Alberta Education

Project Completion Date: Fall, 1978

PREFACE

The Minister's Advisory Committee on Student Achievement (MACOSA) was established by ministerial order in October 1976 in response to growing concerns expressed by the public at large, government, labor, business, students and educators regarding the quality and standards of basic education in Alberta.

MACOSA commissioned a number of studies, primarily to provide basic information for a summary of current levels of achievement in Alberta and to provide baseline data for future assessment. These studies fell into three categories: (1) preliminary studies, (2) achievement studies, and (3) other studies.

The purpose of this study, School-Based Elements Related to Achievement: A Review of the Literature, is to summarize the research into schooling that has shed some light on how educational outcomes are related to such variables as teaching behaviors, classroom climate, teacher expectations and student characteristics.

This report, which represents the findings and conclusions of the researcher, was presented to MACOSA as information.

TABLE OF CONTENTS

SCHOOL-BASED ELEMENTS RELATED TO ACHIEVEMENT

	PAGE
INTRODUCTION	2
PART	
I Process-Product Research	6
Early Studies	8
Recent Studies	11
The Texas Teacher Effectiveness Studies	16
Direct Teaching	23
Subject Matter Effects	26
Summary	33
II Context Variables	39
Classroom Climate	40
Teacher Expectations	46
Pupil Characteristics	52
Mastery Learning	57
Summary and Conclusions	61
III Research in Canadian Schools	68
A Five-Year Summary	68
Views From Three Canadian Research Centers	77
Summary	81
IV Discussion	83
BIBLIOGRAPHY	98

LIST OF TABLES

TABLE		PAGE
I	A Summary of the Research on Indirect Teaching	12
II	A Summary of Rosenshine's Evaluation of Eleven Process Variables	16
III	A Summary of Eight Major Process-Product Reviews . . .	34

A Review of Some Elements Related to Student Achievement

We believe that education needs less heat and more light. Educational problems will not be solved by heaping criticism on schools and teachers, or by advocating new ideas and techniques without showing that they really work. School administrators do not need further abuse; they need specific, data-based information that will enable them to diagnose particular situations accurately and follow through with "treatment" established as effective or at least probably effective in such situations.
- Brophy and Evertson, 1976, p.ix

INTRODUCTION

The object of this paper is to present a summary of the research into schooling that has shed some light on how educational outcomes (product variables) are related to both teaching behaviors (process variables) and classroom contextual variables which show a strong interaction with process variables, such as classroom climate, expectations, and some student characteristics.

Since the paper covers a very wide range of studies in space and in time, the excellent and influential reviews of research that have appeared periodically in books and journals will be used. However, in addition to comparing these reviews a number of recent studies will be reported in greater depth in order to show the kinds of studies currently being carried out, the research designs being used, and the kinds of analyses being done. In this way it is hoped not only to present a summary of the major findings of research, but also to give an impression of the nature of the research enterprise itself.

The paper is divided into four parts; the fourth part is a general summary and discussion of the three preceding parts. This Introduction leads to Part I, which looks at research dealing with the relationship between teaching behaviors (process variables) and achievement (a product variable). This review of process-product research is divided into a summary of earlier research, arbitrarily defined as research up until 1963, and a summary of recent research, from 1963 to the present. Several landmark reviews which appeared in the sixties (e.g., Medley and

Mitzel, 1963; Flanders and Simon, 1969; and Gage, 1965) not only provided excellent analyses and summaries of the then-published research, but also suggested directions for research which have guided many of the later studies.

These later studies have themselves been the object of several important reviews (Dunkin and Biddle, 1974, Rosenshine, 1976) and can be divided into two broad design categories -- correlational and experimental studies. A summary of the major findings, problems, and current trends in process-product research ends Part I of the review.

Part II covers a less readily definable area of independent variables grouped under the general name of context variables. The dependent or outcome variable, achievement, remains the same. Among the context variables considered are socio-economic status, I.Q., groupings, time, classroom climate, and curriculum. All these variables overlap or in some way relate to teaching behavior variables. For example, studies of time as a context variable are related to studies of "providing seatwork" or "attention to task" as process variables, and the study of mastery teaching includes many process variables studied separately as teaching behaviors. Indeed, the distinction between process and context is not always a clear one, and where results from contextual studies appear to relate to results from process studies, they are compared.

Summarizing these studies is not easy since some variables have received a good deal of attention while others have been quite neglected. Further, since contextual variables tend to be difficult to operationalize, sometimes studies which appear to have looked at the same

variable have actually measured different things, or the same thing in different and non-comparable ways. These and other difficulties in interpreting educational research are discussed in the concluding summary in Part IV.

Since one major concern of modern researchers is the growing realization of the "particularistic" or probabilistic nature of research findings, the results of research carried out in Canadian schools is reported separately in Part III. If research findings from the United States (which produces the bulk of those findings reported) show that teacher behaviors that are effective with one group may be ineffective with another, we might expect that the environment in Canadian schools is sufficiently different from that in American schools for the Canadian studies to be looked at separately. Further, we might predict that the process variables showing differential effects in the American studies also might show differential effects in studies of Canadian schools. But would they be the same differences? Comparing samples of American and Australian teachers, Tisher (1971) did find differences in the types and frequencies of some process variables measured by an interaction analysis instrument. Similarly, Hacker (personal communication) has found differences between Canadian science teachers and English science teachers. Thus, while the Canadian studies are presented, for most process variables they are so few that no general statements can be drawn from them. However, the recent setting up of a centre for long-term, multivariate research into teaching, under the leadership of Dr. Al MacKay at the University of Alberta, is an important development.

The five studies that have been completed using observational data from Edmonton area schools are reviewed in Part 111.

PART I

PROCESS-PRODUCT RESEARCH

What is now referred to as process-product research in education includes research that in the past has focussed on teacher effectiveness and teaching methods, styles, strategies and specific behaviors. The trend has been to identify as process variables more specific parts or sequences of the teaching act (soliciting, questioning) rather than a general teaching method (discovery) or style (indirect). The reasons for this narrower choice of process variables are at least twofold: (1) the unsatisfactory results of earlier attempts to relate whole teaching methods or styles to product variables and (2) the difficulty of operationally defining a general method of teaching. These problems have not disappeared in current studies; rather the hope is that enough consistently effective teaching acts or sequences of acts will be identified to allow the building of synthetic models of effective teaching for experimental testing. In other words, the hope is that the consistently productive variables will show a coherence and suggest a theoretical unity of style. The heuristic models of earlier researchers are being put aside in favor of empirically determined models derived from research. Thus the main body of current process-product research relies on sophisticated analysis of naturalistic classroom studies to seek consistent correlations between teaching behaviors (generally verbal behavior of teachers and/or pupils) and selected outcomes (particulary achievement) in an effort to isolate those specific teaching behavior acts which appear to result in consistent pupil learning.

Experimental studies are reported also. Indeed, both kinds of studies continue to be needed, preferably in this sequence: descriptive, correlational, and then experimental studies, as recommended by Rosenshine and Furst (1971) and as followed in the Texas Teacher Effectiveness Project reported below (Brophy and Evertson, 1976).

Observational studies record actual behavior as it takes place, natural and non-manipulated behavior that exists in quantity in actual classrooms. Hence, its proponents say, we are studying real behavior of real teachers and pupils in real classrooms in the real world. If good teaching exists in the real world, we can identify it, and once it is identified, we can emulate it. However, correlations, which are the measure of process-product associations in observational studies, indicate a statistical rather than a natural relation, and repeated significant correlations are required to support a hypothesized cause-effect relationship. As we shall see, the lack of sufficient replication of studies is a serious and general one in educational research.

While experimental studies offer more powerful statistics to support their results, they usually suffer several other severe shortcomings, of which the most often noted is their lack of applicability in general terms. An experimental study is generally unique, short term, highly controlled and by its nature, artificial. Thus any significant results must be limited to the experimental situation and cannot be readily extrapolated to the real, experimentally uncontrolled world of the classroom. Again, only patient replication of studies can provide the support necessary to give them credibility.

Early Studies

The early studies of teacher effectiveness (e.g., Medley, 1972) looked for teacher traits or characteristics that were associated with high achievement. This type of research, comprehensively reviewed by Getzels and Jackson (1963), was generally unproductive, although traits or personality variables such as enthusiasm and warmth still are considered important, and attempts often have been made to operationalize them into process variables (e.g., Soar, 1972 and Rosenshine, 1970).

The "modern" research era in education is considered (Medley, 1972) to have begun in the late 1940's and early 1950's. Its impetus seems to have come from the mental health concerns of researchers such as Anderson, Withal and Lewis, Lippitt and White (Medley and Mitzel, 1963; Medley, 1972; Eggert, 1977) and was translated into such concepts as integrative teaching, democratic teaching and indirect teaching. These concepts were seen in dichotomous pairs: integrative-dominative, democratic-authoritarian, and indirect-direct, and in this research these paired concepts were used as comparative models of teaching. There was a "commitment" (Dunkin and Biddle, 1974) to the educational values embodied by indirect or democratic teaching; they were ideological or heuristic models to be validated by research findings. This type of research is best illustrated by the research of N. A. Flanders and the many workers using the Flanders system of interaction analysis (Flanders 1965, 1970; Flanders and Simon, 1969; Soar, 1972). Flanders pioneered a ten-category system for recording classroom verbal interactions from which he was able to compute the ratio of "indirect" behaviors to "direct" behaviors. The ten categories are:

Indirect Influence:	1.	Teacher accepts feeling
	2.	Teacher praises or encourages
	3.	Teacher accepts ideas
	4.	Teacher asks questions
Direct Influence:	5.	Teacher lecturing
	6.	Teacher giving directions
	7.	Teacher criticizing
Student talk:	8.	Student talk-response
	9.	Student talk imitation
	10.	Silence or confusion

Two ratios of indirect to direct behaviors were computed: "the big I/D ratio" by dividing all tallies in categories 1, 2, 3 and 4 by the tallies in 5, 6 and 7; and the "small i/d ratio," which is the same except for the omission of categories 3 and 4 in an attempt to make the ratio content free (Flanders, 1965). Thus I/D (i/d) ratios as well as individual categories were used in hundreds of correlational and experimental studies, essentially in an effort to show that indirect behaviors, either singly or grouped, produced consistently significant gains in achievement and attitudes. By 1965 Flanders was able to claim considerable support for indirect teaching, and although large numbers of studies offered no significant statistical evidence, Gage (1965) also felt able to include indirectness as one of five encouraging variables to emerge from research on teaching. The other four were: warmth, cognitive organization, orderliness, and problem-solving ability.

Building on the reviews in the first Handbook of Research On Teaching (Gage, ed., 1963), Flanders and Simon felt able to state in the

fourth edition of the Encyclopedia of Educational Research (Ebel, ed., 1969):

> It can now be stated with fairly high confidence that the percentage of teacher statements that make use of ideas and opinions previously expressed by pupils is directly related to average class scores on attitude scales of teacher attractiveness, liking the class etc., as well as to average achievement scores adjusted for initial ability (p.1,426).

Making use of students' ideas and opinions is one of the categories on the Flanders Interaction Analysis System and it corresponds to categories on other interaction analysis instruments (e.g. Medley and Mitzel, 1963; Simon and Boyer, eds., 1967). Although the positive findings related to indirect teaching behaviors are again stressed in Flanders' final report (Flanders, 1970); and in Soar's review (1972) Soar does point out that, "there are a number of studies which find positive relationships too low to be statistically significant, and this with a scattering of negative correlations numerous enough to be difficult to disregard". In full, Soar sees the relationship as being a complex or curvilinear one where there is some optimal match between teacher indirectness (or directness), contextual variables such as curriculum, age and ability of pupils, and outcome measures. This insight of Soar's is perhaps the most useful and still-relevant finding from this period.

Thus, the results of some 15 years of research into the effects of indirect versus direct teaching are inconclusive, although some of the behaviors that Flanders et al categorized (e.g., use of student ideas, praise, criticism) still are to be found in most category systems today (Simon and Boyer, eds., 1967). The ideological basis of that research,

the belief that indirect teaching is better, has been abandoned in most recent research, in favor of a more pragmatic or empirical approach. In other words, many current researchers (e.g., Brophy and Evertson, 1973, 1976) are seeking the consistent correlations between process and product variables from which to build models to be tested later in experimental studies.

Recent Studies

Several comprehensive analyses of past and present research have marked the period of modern research. For example, a comprehensive analysis of more than 110 studies using the Flanders system led Dunkin and Biddle (1974) to reject indirectness as an effective process variable and to conclude that "of 12 variables examined one ('indirectness') has been rejected as a variable while for 10 variables no recommendation could be made for the improvement of teaching" (p.373).

In their opinion only one variable, teacher criticism or disapproval, remained viable, and even this one was to receive equivocal support in future studies (Brophy and Evertson, 1976; Rosenshine, 1976). A summary of their analysis is presented in Table I.

While the early years of process-product research had yielded "meagre" (Gage, 1965) results, by 1971 Rosenshine and Furst were able to list 11 promising process variables in their extensive review of the published research. Reporting on "some 50" process-product studies, Rosenshine and Furst state that "process-product studies have produced some of the best variables on the relationship between teacher behavior and student achievement" (p.21). They go on to list the 11 "strongest"

Table I

A Summary of the Research on Indirect Teaching (From Dunkin and Biddle, 1974)

PROCESS VARIABLE	PRODUCT VARIABLES: Achievement					Attitudes				
	Total No. Studies	Sig. +ve	Sig. -ve	N.S.D. or Uncorr.	Complex (curvi-linear)	Total No. Studies	Sig. +ve	Sig. -ve	N.S.D. or Uncorr.	Complex or Curvilinear
*Indirectness (I/d or I/D)	26	10	-	20	6	14	9	-	5	-
Teacher Praise	15	3	-	11	-	5	1	-	4	-
Accepting Pupil Ideas	8	1	-	6	1	6	3	-	3	-
Criticism	14	-	6	7	1	5	-	2	3	-
Teacher Talk	7	-	-	7	-	6	1	1	4	-
Teacher Questions	7	1	-	6	-	6	1	-	5	-
Teacher Lecture	1	1	-	-	-	-	-	-	-	-
Giving Directions	-	-	-	-	-	-	-	-	-	-
Pupil Talk	5	-	-	5	-	-	-	-	-	-
Pupil Response	1	-	-	1	-	-	-	-	-	-
Pupil Initiations	-	-	-	-	-	-	-	-	-	-

*In addition,
one study showed significantly greater creativity;
one study showed lower anxiety.

Column headings interpreted as follows:

Sig. +ve = Process variable improved product (achievement or attitudes) significantly.

Sig. -ve = Process variable was associated with a decline in academic or attitudinal achievements.

NSD = Process was unrelated to achievements.

variables emerging from their analysis which produced consistently significant gains or correlations with pupil achievement. Other product variables (e.g. attitudes) were not included because they are so infrequently measured.

Only the first five variables were supported by significant results from several studies, but Rosenshine and Furst felt that the next six were promising enough to deserve further study.

These eleven variables are:

1. Clarity (e.g., clarity of presentation, appropriateness of cognitive level)
2. Variability (e.g., variety of instructional materials and activities,

   cognitive variation, flexibility in procedure)
3. Enthusiasm (e.g., stimulating, original, alert, vigorous, involved, interested).

Although enthusiasm, like warmth, is usually considered to be a "presage" variable, where operational definitions or classroom measures of enthusiastic behavior are used, it can be counted as a process variable. (For a full discussion see "Enthusiastic Teaching: A Research Review". Rosenshine, 1970.)

4. Task Oriented and/or Businesslike (e.g., focussing on the learning of cognitive tasks)
5. Student Opportunity to Learn Criterion Material. One of the problems in using standardized tests as criterion measures in naturalistic studies is the possibility of the tests measuring knowledge not taught in the study period. Thus it is important to

know that pupils did indeed have the opportunity to learn the kinds of problems used in the criterion measure.

6. Teacher Indirectness (e.g., teacher use of student ideas)
7. Criticism
8. Use of Structuring Comments (e.g., advance organizers)
9. Types of Questions (e.g., convergent, divergent)
10. Probing
11. Level of Difficulty of Instruction

Rosenshine and Furst conclude that:

> Because of the limited research and because of the methodological problems which may exist in most of these studies, any judgement on the worth of this research would be premature. Instead we believe that there should be at least a second generation of this research (p.31).

Five years later, in reviewing much of this second generation research, Rosenshine (1976) finds consistent results for only four of these 11 variables. Opportunity to learn, task orientation, and direct questions produced positive results while criticism produced negative results. Results for the other other "promising" variables were either contradictory or from such a small number of studies that no definite statements could be made. A summary of Rosenshine's comparison is presented in Table II.

In his article Rosenshine (1976), noting the convergence of research results involving students with low socio-economic status (SES), finds significant positive results for direct time, factual questions, teacher +ve feedback, supervised study in groups, and student attention to task and states that the assembled researchers "thought that these

results could be placed into a tentative pattern labelled direct instruction".

As early as 1974 Dunkin and Biddle, noting in particular the work of Kounin (1970), had found that discipline skills appeared to be very important process variables showing consistent positive correlations with achievement. Other direct teaching variables found by Dunkin and Biddle are supervised group work and teacher-centered instruction. Like Rosenshine (1976), they report mixed or no effects for indirect or higher order cognitive variables such as probing, structuring, higher order questions, divergent questions or higher levels of pupil thinking.

The data leading to these convergent results come mainly from long term studies, in particular, those of J. Brophy and C. Evertson at the Texas Research and Development Center for Teacher Education, Robert Soar and his associates at the University of Florida, J. Stallirg and D. Kaskowitz at the Stanford Center for Research and Development in Teaching, and T. Good and D. Grouws at Missouri.

Table II

A SUMMARY OF ROSENSHINE'S EVALUATION OF ELEVEN PROCESS VARIABLES

Rosenshine & Furst, 1971, 1973	Rosenshine, 1976
1. Clarity	Some +ve but low correlations; may not be an important variable at the elementary level
2. Variability	-ve (however, may be important in some contexts)
3. Enthusiasm	Contradictory: an "ineffective" variable
4. Task Oriented	+ve, but non-significant; only used in one study since 1973
5. Student Opportunity to Learn Criterion (content covered)	Significant (+ve) variable
6. Teacher Indirectness (use of Student Ideas)	Positive trend
7. Criticism	Negative trend
8. Use of Structuring Comments	Used in only one study (non-significant)
9. Types of Questions	Consistently +ve for factual questions; mixed for higher level questions.
10. Probing	No correlation
11. Level of Difficulty of Instruction	Inconsistent

The Texas Teacher Effectiveness Studies

The Texas Teacher Effectiveness Studies are a good example of the best "second generation" studies called for by Rosenshine and Furst (1973). They were carefully prepared through pilot studies, well-designed, and longitudinal, and they used large representative samples of teachers and pupils (Brophy & Evertson, 1973, 1976).

For example, the Texas researchers began by testing a large sample of teachers to see if their ability to produce achievement gains was consistent over a three-year period. This preliminary study echoed a concern voiced by Rosenshine (1970b) that his reading of the research

showed little evidence of data to support the assumption of all process-product research that teacher effects are stable over time.

Clearly, stability of effects is a critical requirement for process-product research, and indeed Brophy and Evertson were able to show that enough teachers from their sample of 165 were consistent enough to allow them to proceed with their study. These teachers showed consistent effects (achievement) across time (three years), sex (boys and girls), and subjects (mathematics and language arts) but showed a normal distribution with respect to degree of effectiveness. Thus, these teachers would not necessarily be those teachers who produced the highest achievement gains in any particular year. Brophy and Evertson (1973) conclude:

> The correlations were high enough to indicate that stability of teaching effectiveness, at least amongst experienced teachers, is higher than the data in the studies reviewed by Rosenshine (1970) suggested, and there were enough stable teachers in the sample of 165 to enable us to follow through with our plan to concentrate on teachers who were consistent across time in their relative effectiveness. However, the correlations were moderate rather than high, indicating among other things that it would be unfair and inappropriate to use student learning gains on standardized achievement tests as the basis for making decisions about teacher promotion, pay raises, etc. (p.164).

In addition to noting the implication for teacher evaluation, Brophy and Evertson show that their findings of consistency offer evidence to counter Coleman's 1966 assertion that teachers do not make a difference.

However, within these patterns of consistency the Texas researchers found a strong "cohort" effect (Brophy and Evertson, 1973, 1976). That

is, the effect of any particular class was as strong as or stronger than the overall correlation for stability. Thus, even teachers producing consistent effects show variability due to the interaction of contextual and/or presage variables with process variables that conceivably contribute to the cohort effect.

In comparing a group of consistently effective teachers to a group of less consistently effective teachers, Brophy and Evertson (1976) found the former to be strikingly more traditional than the latter in certain traits or presage variables. Specifically, the former were distinguished by the following 10 characteristics:

1. Teachers insist that students stay in place and work.
2. Teachers rigidly follow a planned schedule.
3. Teachers require that students stand while reciting.
4. Teachers feel that materials other than tests are unimportant.
5. Teachers believe that low grades reinforce effort by making students work harder to improve.
6. Teachers believe they should spend more time talking to the whole class rather than to individuals.
7. Teachers believe they should urge students to do better work.
8. Teachers state that the proper strategy after getting a wrong answer is to ask another student for the answer.
9. Teachers believe they should require more from their abler students.
10. Teachers feel it is their responsibility to see that the students have supplies at their desks (p.23).

For the observational study, the Texas group used a sample of 31 consistently effective teachers in the second or third grade in the Austin Independent School District, Texas, divided between Title 1 schools (low SES) and non-Title 1 schools (high SES). Grades 2 and 3 were chosen because the establishing of outcome criteria is easier at the primary level. Although individual teachers and even school districts sometimes differ in their rankings of the desirable outcomes of schooling, these differences can be minimal at the lower elementary

grades where all agree on the centrality of learning the basic skills of language and computation. While some teachers would place more stress on social skills, creativity or self-expression, all would agree on the importance of reading, spelling and arithmetic. Hence, the use of standardized tests as criterion measures seems justified. As Brophy and Evertson (1973, 1976) point out, at the junior high and senior high school levels, where curricula diverge and there are fewer agreed upon universal skills or areas of knowledge, the use of standardized tests is less reliable. We have noted that the opportunity-to-learn criterion is one of the process variables for which Rosenshine finds considerable support in both his reviews. (See Table II.)

To record the process variables (teacher and pupil behaviors) both high inference (subjective observations and highly inferential categorizations such as check lists) and low inference (relatively objective recording of observations and less inferential categorizations such as interaction analysis schedules) instruments were used by coders who had been tested for reliability. (See Brophy and Evertson, 1973 and for general discussion Emmer, 1972.) Correlations were calculated to relate individual process variables to outcomes, and an analysis of variance compared the two contextual variables (low SES and high SES).

The latter analysis resulted in the major finding that there was a cluster of teacher behaviors which were effective in Title 1 (low SES) classes but were less affective or even ineffective in non-Title 1 (high SES) classes.

> The importance of school SES appeared in a two-way analysis of variance (Title 1 vs. non-title 1 classrooms and grade 2 vs. grade 3 classrooms as the classifying variables) carried out on all of the

> measures available at the time. These analyses showed that although grade was relatively unimportant (the main effect was significant for only 4% of the variables), the main effect for Title 1 vs. non-Title 1 classrooms was significant for 25% of the measures (Brophy and Evertson, 1973, p.36).

Since the process data from just one of the instruments gave 15 values for each of 141 variables and the results take up 25 pages of text and 22 pages of tables, the interpretation of significant findings is complex and difficult. (See Brophy and Evertson, 1973, 1976.) However, the main findings were:

1. Classroom Management

   Low SES classrooms need more tightly structured management, with higher SES classrooms showing more ability to operate on individual responsibility. In general, classroom management skills were important correlates of achievement.

   Of the process behaviors measured through classroom observation in our study, the group that had the strongest and most consistent relationships with student learning gains dealt with the classroom management skills of the teachers. By management, we mean planning and conducting activities in an orderly fashion; keeping students actively engaged in lessons and seatwork activities and minimizing disruptions and discipline problems (Brophy and Evertson, 1976, p.51).

2. Matching Teaching to Student and Abilities

   The more successful teachers in the low SES schools moved at a relatively slow pace and spent much time teaching and reteaching the basic fundamentals of reading, writing, arithmetic. Most assignments were at the level of skill practice and factual memory. In contrast, the more successful high SES teachers blended in some problem solving and other high level activities which involved application of the skills as well as mastery of the skills themselves (p.66).

3. Motivation and Incentives

   In general, the most successful low SES teachers motivated primarily through gentle and positive encouragement and praise, while the successful high SES teacher motivated through challenge and through

a critical demandingness which involved communicating high expectations to their students and criticizing them for failing to meet them (p.89).

Some of the specific findings that these statements are based upon are:

Process Variable	Title I (low SES)	Non-Title I (high SES)	Comments
Patterned Turns	+ve	+ve	More effective than choosing children at random.
Practice and Immediate Corrective Feedback	+ve	+ve	Especially significant in low SES classes.
Clarity	Unrelated	Unrelated	Unimportant variable at this level.
Pacing	+ve*	Some +ve	Over-teaching effective with low SES classes; faster pace with high SES classes.
Control Interaction	+ve	Some +ve	Teacher maintains control.
Praise	Some +ve	Some -ve	Correlations not strong or consistent.
Rewards	-ve	-ve	Housekeeping chores, monitor duties, etc.
Criticism	Some -ve	Some +ve	Occurred infrequently.
Punishment	Unrelated	Some +ve	Most effective teachers avoided "need" to punish as much as possible.
Indirect Teaching (use of student ideas)	Unrelated	Unrelated	Possibly not appropriate with young children.
Structuring (advance organisers)	Unrelated	Unrelated	"
Teacher directiveness (cognitive level/ authoritarian/democratic	"	"	"

Choosing volunteers	+ve	-ve	
Level of questions	Mixed	Uncorrelated	
% correct answers	Mixed	-ve	
Frequency of public response opportunities (questions)	Unrelated	+ve	Shows some support for Flander's studies (i.e. student talk) with high SES.
Student indicates comments	+ve	-ve or unrelated	Seems inconsistent with above.
Student indicates questions	+ve	-ve or unrelated	Occurred relatively infrequently.
Callouts (unrecognized student comments or questions)	-ve	+ve	May reflect classroom comments.
Opinion and self related questions	-ve	-ve	Questions not dealing directly with subject content often used to introduce activities or lessons.

These results seem to suggest two principal conclusions. First, teaching behaviors that are successful with one group of children may not be successful with another group. In the case of the Texas studies the difference in groups has been defined as a difference in SES. However, similar differences might be expected with groups differing in other and perhaps more subtle ways. Indeed, in suggesting that certain categories of behaviors (e.g., cognitive level of questions, indirectness) may not be relevant at the early education levels, Brophy and Evertson (1978) reinforce their finding of the need to match teaching behavior to some student characteristics. They are the first to admit that good teachers have been doing this for as long as they have been teaching. However, common sense is not always supported by research findings.

The second general conclusion is that direct teaching behaviors (efficient classroom management skills, emphasis on task, seatwork) are generally effective in producing achievement gains, expecially in early elementary, low SES classrooms. Again a match between teaching style and pupil ability is suggested although the results here indicate that direct teaching may be generally effective in early elementary classrooms.

Direct Teaching

In his 1976 review of process-product research, Rosenshine (1976) notes this pattern of direct instruction for children from low SES backgrounds also emerging from the studies by Soar (1973) and Stallings and Kaskowitz (1975). Similar findings also were reported by Good and Grouws (1977) in their study of largely middle class fourth-grade mathematics classrooms, a study which also used teachers found to be consistently effective over two consecutive years. These teachers were divided into two groups--relatively effective yet consistent teachers versus relatively ineffective yet consistent teachers--and the groups were compared. Good and Grouws (1977) summarize their findings as follows:

> Teaching effectiveness (as operationally defined in this study) appeared to be strongly associated with the following clusters: (a) student initiated behavior; (b) whole class instruction; (c) general clarity of instruction, and availability of information as needed (process feedback in particular); (d) a non-evaluative and relaxed learning environment which is task focused; (e) higher achievement expectations (more homework, fast pace); and (f) classrooms that were relatively free of major behavioral disorders (p.53).

Further support for specific aspects of direct teaching at the early elementary grades can be found in Gage's studies of teacher structuring (1976), Bloom's studies of time and directing learning (1974), Wright and Nuthall's studies of questioning strategies, (1970) and some of the research on open classrooms (e.g., Wright, 1975).

Rosenshine sees this model of direct teaching as having the following characteristics:

> Time is structured by the teacher, and a large portion of time is spent on a number of reading activities. There is a predominance of seatwork in academic workbooks. Materials are broken into small steps. Sufficient time is allotted for completion of these tasks.
>
> Questions are narrow, direct, usually with a single answer, and structured to obtain a high percentage of correct answers.
>
> Teachers or materials provide immediate feedback using praise and acknowledgement of student answers. There is little discussion or probing of the answers--correct answers are followed by another question and incorrect answers are followed by the teacher giving the answer.
>
> Students work in small or large groups supervised by the teacher for instruction or for seatwork. There is little free time or independent-unsupervised activity.
>
> There is less off-task student behavior. This may occur in systematic, structured, supervised setting and the management system.
>
> In addition to the above, the following may be reasonable extrapolations, although they appear in only one or two studies:
>
> The teacher is the dominant leader who decides which activities will take place. The learning is approached in a direct business-like manner and is organized around questions posed by the teacher or the materials. The materials and the instruction is systematically organized, proceeding within small steps. Goals are clear and known to the students. Yet, within this task setting the teacher is warm and convivial, frequently giving praise and encouragement to the students for academic work (Rosenshine, 1976, pp.12-13).

Clearly research in process-product variables in the early elementary grades, expecially with children from low SES backgrounds, has yielded the most convergent results to date. However, we do not yet know how easily this model may be applied to schools in general. Even within the framework of the classrooms they were studying, Brophy and Evertson (1976) were careful to point out the variability and the need for a match between teacher and pupils. A similarly cautious tone is sounded by Webb (1971), who found that lower ability ("c" lane), insecure, and school-problem students responded significantly better to teachers whom they perceived to be "sensitive." Problem-free students, on the other hand, did not appear to respond differentially to the two types of teachers. Again, rather than making a universal case for the "person-oriented" teacher, Webb concludes that:

> This is not to condemn the task-oriented or rigorously academic teacher; in fact, it could be argued that for some students the more objective teachers are more interesting and stimulating (p.457).

Thus, important questions remain about the general status of direct teaching--not only about its effectiveness across ages, SES backgrounds, and abilities, but also about its effect on other product variables such as attitude, creativity and social skills. However tentative we may consider these results or however trite and obvious their conclusions, no such convergence of research exists at any other level of schooling. Few long-term, multivariate studies have been carried out at the junior and senior high school levels possibly because of the difficulties in designing such studies (eg., the problems of choosing criterion measures).

Subject Matter Effects

The Texas team replicated their study at the junior high school level (Evertson & Brophy, 1977; Minter, Evertson and Brophy, 1977; Anderson, Evertson and Brophy, 1977; Edgar, Evertson and Brophy, 1977). Noting the need to control for contextual effects if clear process-product relationships are to be established, Evertson and Brophy (1977) state their goal as, "to identify classroom processes and teacher characteristics which are generic and stable and those which are situation specific" (p.2). The researchers looked for (1) behaviors which varied across sections of the same subject matter, (2) behaviors which varied across subject matter, and (3) behaviors which appeared to be affected by individual student variations across two different classes and teachers. In addition to the high and low inference instruments used in their previous study, the Texas team included a measure of student attitudes and a criterion-referenced achievement test which was covaried with the standardized California Achievement Test. Subject matter differences were marked: "These data indicate that teachers tend to be stable in their behaviors across time but subject matter differences are present and clear-cut" (p.7).

What are these clear-cut differences? The following is a summary of the significant differences reported between English and math teachers.

1. Types of Questions. English teachers used more opinion questions, and math teachers used more process questions (e.g., why...). English teachers also used slightly more product questions, yet the high inference scales showed math teachers seeking more convergent (correct)

answers than English teachers.

2. Selecting Respondents. English teachers pre-selected and patterned their choice of respondents (used a predictable order of respondents) and received more correct answers than did math teachers.

3. Criticism. Although criticism was quite infrequent in all classes, math teachers criticized "don't knows" and "no responses" more often than English teachers did.

4. Use of Time. Math teachers spent more time at the board and lecturing; they used a presentation style. English teachers spent more time on special projects involving a variety of groupings and media, and they used advanced organizers to introduce new topics. On the high inference scale students were scored as more attentive in English classes than in math classes.

5. Student Talk. A comparison of the total amount of student talk in the two types of classes is not given. However, the types of student talk were quite different. Student questions made up the greater part of student talk in math classes, while student comments, including called-out comments, were significant in English classes.

6. Feedback. English teachers gave more praise in their feedback but math teachers gave more lengthy, process feedback.

7. Dyadic Contacts. Lengthy, content-related contacts occurred more often in math classes, while procedural or personal requests were accepted in English classes.

8. Discipline. More minor misbehaving occurred in English classes and was responded to mildly (often non-verbally) by the teachers, who made few "target errors" (i.e., they correctly identified misbehaving stu-

dents). Less misbehaving occurred in math classes, but it was of a more serious nature and received a more severe response from the teachers, who made more target errors than the English teachers.

Overall, the junior high math teachers were more "businesslike" and task oriented or even authoritarian with students who were judged on the high inference scale to be "usually unhappy." English teachers appeared to personalize their approach by means of special activities, more personal and opinion questions, more praise, more tolerance, and acceptance of student comments. They were more "democratic" and students found them more "comfortable" (e.g., to go to with a problem) than math teachers.

Student behavior was found to be stable across the two subjects.

Although the two studies are not completely comparable and all the data are not yet available from the junior high study, here the interaction or match seems to be quite different from that found in the elementary school study. Using the results of the latter study, Brophy and Evertson (1976) had suggested that indirect teaching behaviors were perhaps inappropriate at the early elementary grades but might become more important in the later grades. However, instead of age or grade level being the interacting, contextual variable at the junior high school level, clearly the match here is between teaching behaviors and subject matter. Further, since student behaviors and, for the most part, attitudes remained stable across subjects, it would appear that student characteristics do not determine teaching behaviors in these classrooms. More data about controls in this study are needed. For example, was cohort effect measured, was pupil SES controlled, and what relationships with achievement were found?

The main finding of a subject matter, teaching style interaction is clear and unprecedented except for a British study (Eggleston et al, 1976) which found there was a dominant teaching style among secondary teachers of biology, chemistry and physics. If this finding is supported by more replication studies, the question of the determination of the interaction will become important.

Anticipating the question, Edgar, Evertson, and Brophy (1977) state:

> It is possible that subject matter determines teaching style, or that the individual's personality determines his college major and therefore what subject he will teach, or perhaps the situation is explained by some interactions of the two explanations (p.8).

Some helpful data already exists. Fedigan (1971) was able to show that English teaching candidates showed significantly higher conceptual levels than social studies teaching candidates, and that conceptual level was related to initial teaching style. This latter result had also been obtained by Hunt (1970), Hunt and Joyce (1967), and Murphy and Brown (1970), together with some elements of a match between teacher conceptual level, teaching behavior and pupil conceptual level (Hunt and Hardt, 1976; Tomlinson and Hunt, 1970; Fedigan, 1973; Hunt et al, 1974).

Further evidence of both a subject matter and a grade level interaction with teaching behaviors is provided by McDonald's (1976a, 1976b) studies of second and fifth grade reading and mathematics classrooms. The following summary is taken from MacDonald (1976b).

Grade 2

Reading	Mathematics
+ve predictors:	+ve predictors:
- direct individual instruction	- amount of content covered
- teaching class as a whole	- direct individual instruction
	- keeping pupils on task
-ve predictors:	-ve predictors:
- independent seatwork	- teaching class as a whole
- variety of instructional goals	- explaining, discussing, questioning
- complexity of organizational structure	- positive feedback (praise)

Grade 5

Reading	Mathematics
+ve predictors:	+ve predictors:
- discussing, explaining, questioning	- teaching in groups
- individual seatwork	- teaching class as a whole
- teacher mobility	- practice and review
-ve predictors:	-ve predictors:
- disorganized instruction	- individual seatwork
- inattentive pupil behavior	- inattentive pupil behavior

Behaviors designed to keep students' attention focussed on the learning tasks at hand are central to all four situations, but this attention is achieved in slightly different ways. McDonald (1976b) summarizes the grade differences thus:

> At second grade, discrete responses are being acquired and linked together. Therefore continuous monitorings of the acquisition process are probably needed. At the 5th grade cognitive processes to be used with varied content are being learned. Teaching strategies which stimulate comprehension processes are probably acquired (p.319).

In other words, more indirect teaching behaviors involving higher order cognitive activities are increasing as students progress to higher grades. Differences between subject matter in effective teaching behav-

iors also are subtle, and appear to be related to the organization of instruction and the use of materials (McDonald, 1976a).

> Results for grade 2 mathematics and grade 2 reading present an interesting contrast. The results suggest that an organizational pattern combining group instruction and individual monitoring of performance is effective in teaching reading, but more individual monitoring and less group work is more likely to be an effective instructional pattern in teaching mathematics (p.41).

By grade 5, the subject-matter differences are becoming more marked.

> In general the character of reading activity in grade 5 is continuous reading of more complex materials that require thinking, understanding of concepts and principles, and analysis of meanings. Such learning is more likely to occur if teachers spend considerable time discussing, explaining, questioning, and in general stimulating cognitive processes.... For grade 5 mathematics, the critical domains of teaching performances seemed to be the methods of instructional organization, and the range of instructional content covered. In general, group instruction is more effective than individual instruction in 5th grade mathematics (p.42).

As in the Texas junior high school study, mathematics teachers are seen to be more business like or direct-authoritarian than are language arts teachers. Anecdotal support for such findings is supplied in a 1975 Canadian study by Boak and Conklin. Although they do not report large effects on achievement or anxiety for teachers divided into high and low groups on the basis of their level of interpersonal skills, Boak and Conklin do report that:

> Several mathematics teachers involved in the research indicated that their personal orientation, because of the objectivity of the mathematics discipline, inhibited them from responding to students' personal experiences as they might be able to in a language arts class where the content of the subject might lend itself better to the students' exploration of values and meaning in their life (p.541).

Part of this study involved training teachers in interpersonal skills. However, there was little difference between the high and low groups (Boak and Conklin, 1975), and although both language arts and mathematics teachers were included in the high group after training, all 10 mathematics teachers had been found to be low in interpersonal skills in the pre-training test. The qualities of humanism or indirectness described for language arts teachers might be expected to be present in social studies teachers as well. However, Davis (1967) found no difference in their use of higher-order questions or questioning strategies, while Fedigan's (1971) findings suggest that in fact they may be more like mathematics teachers than like language arts teachers in some presage measures. Further, in his attempt to draw a cognitive map or "press" of teaching at the high school level, Walberg (1974) shows that mathematics is characterized by more convergence than is language arts:

> Associated with mathematics (convergence) are scales dealing with analysis and memory and the affective conditions of test and grade stress, absence of humor and little discussion. The scales associated with the language arts (divergence) side of the dimension have to do with the cognitive objectives of interpretation, evaluation, synthesis, and translation. Affective process includes student independence and participation in discussion (p.253).

Walberg (1974), who discusses similar findings from studies carried out in Illinois and Montreal and in related studies, finds that the relationship between the cognitive level of classroom processes and grade level also is curvilinear, peaking in the early junior high years only to drop sharply to a low in grades 10 and 11 before rising again in Grade 12. So a complex network of interactions between grade level, subject matter and teaching behavior appears to exist, and this network

produces good results only where the interacting variables are well matched. More of these interactions between process and context variables are reported in Part II.

Summary

A summary of conclusions from eight of the major research reviews done over the past 15 years reveals some important changes when presented in table form (Table III). Clearly, indirect teaching and the specific behaviors associated with it (e.g., use of student ideas) still receive little support from research, to the point where Dunkin and Biddle 1974) talk of rejecting the variable completely. However, Brophy and Evertson (1976) and Rosenshine (1976) are more circumspect in stating the following four ideas. (1) Indirect behaviors, like higher order questions and variation in structuring, may be found to be more effective with older or higher SES or higher ability children, and with some subject matters. The Eggleston (1976) findings support the notion of this kind of relationship between cognitive teaching style and subject matter. (2) Variables such as warmth and enthusiasm, which are hard to define operationally, are not productive process-variables. (This is not to say that they are not productive or important qualities in teaching (Gage, 1969) or indeed, in any other human activity.) (3) Recent studies, especially with low SES children, find much support for direct teaching at the early elementary grades while other studies report a subject matter/teaching style interaction becoming more marked at higher grade levels. (4) The results of process-product research still are rather "meagre" (Gage, 1965) and such research still is too

Table III

A SUMMARY OF EIGHT MAJOR PROCESS-PRODUCT REVIEWS

Withall & Lewis Medley & Mitzel Wallen & Travers 1963	High scoring students (S.A.T.) do well in learner-centered classrooms. Low scoring students do better in teacher-centered classrooms. "A reading of these studies (ratings of effectiveness) reveals uniformly negative results" (p.257). Little or no support for studies comparing teaching styles (e.g., lecture versus discussion, recitation, project).
Gage, 1965	Warmth, cognitive organization, orderliness, indirectness, problem-solving ability related to achievement and attitudes.
Flanders & Simon, 1969	Indirectness (use of student ideas) related to achievement.
Soar, 1970	Complex or curvilinear relationship between indirectness and pupil achievement.
Rosenshine & Furst, 1971, 1973	Clarity, variability, enthusiasm, task oriented, student opportunity to learn criteria, indirectness, criticism, use of structuring comments, types of questions, probing level of difficulty of instruction are most promising variables relating to achievment.
Dunkin & Biddle, 1974	Indirectness rejected. Discipline skills, supervised seatwork, teacher-centered instruction related to achievement.
Averch et al, 1974 (Rand Corp.)	Little stability in teacher effectiveness, differential effectiveness (matching), poor generalizability from experimental studies.
Rosenshine, 1976	Factual questions, time spent in learning, student attention to task, supervised seatwork or group work, positive feedback, direct instruction consistently related to achievement gains in lower elementary grades, especially with children from low SES backgrounds.

undermanned and underfinanced. Rosenshine (1976) was able to list no more than 13 researchers or groups of researchers currently working in the field and, he states, "(since 1975) fewer than 25 studies have been conducted on any specific variable such as teacher praise or teacher questions and these studies are spread across all grade levels, subject areas and student backgrounds" (p.1).

Assuming, as we must, that the recent long-term, large-sample, carefully designed studies (such as the Texas studies described earlier in this paper) provide us with the best available data, the following tentative conclusions can be drawn.

1. Enough elementary school teachers are consistent enough in their ability to produce achievement gains across years, sex and subject matter that the research for generic process variables is warranted.

2. In spite of the above, there is a marked yearly or cohort effect. Note that this cohort effect is distinct from a whole school or student body effect. The latter is a very disputed effect, which receives support from studies such as Mitchell's (1973) but is found unproven in, for example, the Rand Corporation review (Averch et al, 1974). The class or cohort effect raises widely discussed methodological questions regarding the use of the class or the individual student (or the whole school) as the unit of analysis.

3. The consistent teachers are not necessarily the "best" or the most successful teachers at any particular time (in any particular year).

4. By restricting observational research to those teachers who demonstrate consistency or stability of effects over time, we may be ignoring

a population of teachers who, although less consistent than the former, may show greater flexibility, creativity and innovation in their teaching.

5. The consistent teachers studied are more traditional in their attitudes and beliefs about teaching than a comparable sample of less consistent teachers.

6. The most consistently successful teachers of second and third grade low SES children in language arts and math use direct teaching behaviors.

7. The same constellation of direct behaviors is not demonstrated to the same degree by successful teachers of second and third grade high SES background children or by reading and English teachers.

8. There appears to be a logical or "common sense" link between the conservative (traditional) teacher, consistency, and the direct behaviors that are the significant findings of these studies. However, do they fit together as a general model of effective teaching, or as a necessary result of using this particular sample of teachers? In other words are these findings independent of each other, or have we identified one group of conservative/direct teachers who are able to produce consistent gains in achievement? If we have done the latter, can the specific behaviors exhibited by these teachers be considered generically and recommended to all or any other teachers, or are the beliefs and behaviors all of a piece and largely inseparable? This very question is raised by the controversial Lancaster studies (Bennett, 1976). The author of these studies done in England claimed that they show that direct or traditional teaching methods are universally successful; that is, with all children in all types of schools. However, to note only

one of the very serious flaws pointed out by reviewers (e.g., Rogers and Baron, 1977; Wragg, 1976; Hunt, 1976; Choppin, Bossert and Rosenshine, 1978), out of more than 400 teachers in the study sample, Bennett chose for his analysis only those 30 whose profiles showed very traditional attitudes and beliefs (very similar, in fact, to those in the Brophy and Evertson study). Bennett, at least, seems to be a victim of a self-fulfilling prophecy: to choose only effective, traditional teachers and then discover that they use traditional (direct) behaviors in the classroom is hardly shedding light on our subject, but the claim for universality surely is generating heat.

9. There may be an optimal mix of direct and indirect behaviors for any teacher/pupil(s) combination, with variation due to SES, ethnicity, age, grade, ability, subject matter or other presage or contextual variables.

10. Experimental studies are needed now to test the direct teaching model for lower elementary grades, while more correlational studies are needed to establish the subject matter teaching style interactions that have been reported for the junior high and senior high school levels.

11. Given the apparently significant effect of presage and/or contextual variables (e.g., SES) on optimal teaching behaviors (process variables), studies from Canadian schools are needed before we can make valid generalizations for Canadian classrooms.

In summary, progress has been made. While we still seek generic process variables, or groups of variables, we no longer believe or are "committed", to use Dunkin and Biddle's term, to the search for the one universal teaching method or style that is right for all teachers in all

classrooms. On the contrary, we have a lot of both direct and indirect evidence which indicates the necessity of matching presage variables, contextual variables and process variables in order to produce a whole that has a powerful existential, even synergistic, dimension that has been identified with the cohort effect. A number of the characteristics of this match have been defined for one context--low SES classrooms where traditional teachers using direct methods appear to be consistently effective. Also, there is a strong suggestion of a subject matter/teaching style relationship at higher grade levels.

However, while we now are predicting the success of a variety of teaching strategies, each to be used in the right situation or context, the not-too-surprising finding that teachers with traditional attitudes translate them into traditional teaching methods should tell us that attitudes and beliefs probably place limits on the flexibility of behavior of individual teachers. Probably the model of the teacher as a diagnostician/ clinician, an infinitely flexible actor with a wide variety of stratagems and styles to suit the diagnosis, is unrealistic. Unless the success of direct teaching is repeated at other grade levels, with children of high SES and/or ability and motivation, other matching patterns can be expected to emerge.

The following review of some of the research which relates contextual variables to achievement presents more support for matching or interactive effects. Then, in Part IV selected theoretical and empirical approaches to the problem are discussed.

PART II

CONTEXT VARIABLES

As some of the research presented in Part I shows, context variables (e.g., SES, age, ability) often interact with process variables, and more of these interactions between context and process variables are examined in this section. Since these contextual effects are difficult to separate from the effects of presage or process variables, they have been found to run the gamut from negligible, as in the search for a universally effective teaching method or style, to overpowering, as in the kinds of studies that equate achievement in schooling solely with presage or contextual variables such as SES and parental occupation (e.g., Kennedy and Bush, 1976). The former situation has been common in research on teaching; the latter often is found in research with a sociological bias and has led, not unexpectedly, to the claim that what takes place in classrooms, or indeed within the school, has no significant effect on the outcome of schooling (e.g., Coleman, 1966; Heath and Nielson, 1974).

Context variables can be grouped, albeit arbitrarily, into three classes (Dunkin and Biddle, 1974):

1. Organizational variables such as class size, facilities, availability of professional staff, salaries, course offerings, and timetabling;

2. Program variables such as curriculum, variety of materials, and use of T.V. and media;

3. Student characteristics such as age, grade level, sex, ethnicity, socio-economic status (SES), I.Q., ability, cognitive style, and anxiety level.

Many of the most powerful interactions occur between variables from this third group and process variables. Consequently, most of the context variables reviewed here come from this group. Clearly some of these variables do affect a child's classroom learning and, equally clearly, optimal learning is most likely to occur when there is an appropriate match between presage, context and process variables.

Some of the variables considered here, such as classroom climate and teacher expectations, are themselves the product of interactions among context, process and sometimes presage variables, some of which have been reviewed under the guise of process variables (e.g., indirectness) in Part I. Results which have presented earlier will not be repeated, but they will be referred to when their significance to the context variables under review seems apparent.

Classroom Climate

Classroom climate has been cited as an example of a "high inference" or abstract variable. It is often used as a context variable, but its measurement generally involves process variables. Thus, calculations of indirect or democratic or integrative classroom climates usually involve measures of specific teaching acts such as "accepting student ideas", which are themselves process variables. (The generally unsatisfactory results of the process measures of indirectness has been

reported in Part I). However, some aspects of that large body of research bear re-examination here.

Soar (1972) has already been quoted as noting the complex, curvilinear nature of the relationship between indirectness and achievement. In other words, in any situation there may be an optimal level of indirectness beyond which or below which achievement flattens out or even declines. Many contextual variables could conceivably contribute to this optimal match, only a few of which have been adequately studied. Indeed, the whole range of student characteristic variables could be expected to enter the interaction in some situations. Support for Soar's postulate of a complex relationship between indirectness and achievement comes from re-analysis of many of the earlier Flanders studies. Nuthall (1974) re-examined Flander's data without the latter's assumption of a simple, linear relationship between process and product variables. Instead of using simple (linear) coefficients of correlation Nuthall calculated correlation ratios to test for curvilinear or complex relationships and found that many previously non-significant results then became significant. Commenting on Nuthall's re-analysis, Dunkin (1976) wonders whether the negative conclusions about indirectness reached, in reviews of process-product research by Dunkin and Biddle (1974), Rosenshine and Furst (1971), and Rosenshine (1976) would not have been greatly changed had the reviewers re-analysed the data in similar fashion. Again the suggestion is that one or more interacting contextual variables such as age, grade, SES, ability or motivation are responsible for the complex relationship between teaching behavior and achievement.

Soar himself (1968) himself, has suggested that the optimum degree of indirectness is lower for concrete learning tasks than for more abstract learning, and if we assume that more of the former kinds of learning take place in the lower elementary grades, this suggestion receives support from the results of the Texas Teacher Effectiveness Study (reported in Part I of this study) and from the 1976 review by Rosenshine. Flanders (1965, 1970) reported that high anxiety students achieve more under conditions of indirectness than do low anxiety students. Similar results are reported for other apparently related student characteristics, such as dependent-prone and less dependent-prone, and for some measures of ability or I.Q. (Averch et al, 1974; Dunkin and Biddle, 1974; Stanton, 1974; Parent et al, 1975). Indeed, anxiety alone may have an effect on achievement, as the Rand Corporation analysts (Averch et al) note:

> Across many studies there are indications of an interaction between anxiety and intelligence on cognitive performance; anxiety appears to enhance the performance of low ability students and decrease the performance of high ability ones (p.92).

So, the interaction may be at least a three-way one, involving teaching behaviors, level of anxiety, and ability.

Good et al (1973) turn around the proposed direction of interaction between teaching behavior and achievement by proposing that lower pupil achievement produces greater teacher directness. Here one is tempted to return to the findings regarding the effectiveness of direct teaching behaviors in low SES classrooms (Rosenshine, 1976) and to suggest a similar redirection of the relationship with the added interaction of SES and ability. There is a suggestion, especially in the work of

Brophy and Evertson (1973, 1976), that the low SES classrooms they studied contained high numbers of low achievers. Thus, one could follow Good et al (1973) and suggest that effective direct teaching was the product of teachers reacting to low ability students rather than the imposition by the teachers of a happily effective teaching style. Although more studies are needed to resolve this "directional" problem, it seems likely that interactions take place in both directions under different conditions.

Of course, not all low SES children are of low I.Q., ability or achievement, but low SES does appear to make success in school more difficult to attain (Flanagan, 1969). For example, although children with above-average intellectual ability usually overcome the effects of a deprived home environment, it is more difficult for a high I.Q., low SES student to go to college than it is for a low I.Q., high SES student. The fact that there is generally quite a good overall correlation between SES and achievement should not be allowed to hide the fact that there is great variability in I.Q. and achievement at all levels of SES, nor should it lead to the kind of social determinism that can result from the simple application of the predictive relationship of SES to ability and achievement in school.

Student behaviors or characteristics cannot be used to explain the subject matter differences reported in the Texas junior high school study (Evertson and Brophy, 1977) since student behaviors were found to be stable across subjects. Dunkin and Biddle (1974) do conclude that "teacher indirectness varies with the intelligence level of the class",

but they also note that other findings indicate that indirectness and directness are independent of each other.

Other assessments of the importance of classroom climate seem at odds with those just reported, and perhaps this reflects the difficulties of comparing studies using different definitions of "good" or effective climate and different criterion measures. More importantly, these studies usually have sought a simple linear relationship between classroom climate and achievement. For example, Stern (1963) in his summary of research into classroom climate states:

> In general, it would appear that the amount of cognitive gain is largely unaffected by the autocratic or democratic tendencies of the instructor (p.426).

However, Nielson and Kirk (1974), in reviewing classroom climate research 11 years later, find few studies relating climate to achievement. They conclude that:

> Of the few studies where a relationship exists, six indicate a positive relationship between a "good climate" and higher achievement and four show no significant relationship (p.74).

In addition to the problems of the definition and measurement of "good climate", here there is also the possibility of becoming trapped in circular or tautological reasoning.

Anderson and Walberg (1974), in reviewing research on Learning Environment Inventory scales (LEI scales) which also measure classroom climate, claim that the "LEI scales account for 13%-46% of the variance in learning" (p.91). Clearly, they see learning environment as a significant contributor to student achievement. In addition learning environment measures have been found to be good predictors of general and

academic self-concept (e.g., House, 1975). Measuring these classroom climate variables or "classroom processes" from the students' perceptions, Walberg (1974) also finds evidence of a complex or curvilinear relationship between the students' perceptions of the cognitive level of classroom processes (e.g., memorize, find trends and consequences, practice, discover many solutions, know best answer) and the grade level. Student responses show cognitive processes as tending to peak at the early junior high grades, only to drop sharply to a low level (e.g., much memorization and need for right answers) in grades 10 and 11 before beginning to rise again in grade 12. There is some parallel between levels of cognitive processes and some measures of direct and indirect teaching, but the concepts certainly are not interchangeable.

Still using students' perceptions of cognitive processes in the classroom, Walberg (1974) reports distinct subject matter, "cognitive press" interactions, some of which offer additional support to those already reported in Part I. Mathematics and language arts classes were separated by a convergence-divergence function:

> Associated with mathematics (convergence) are scales dealing with analysis and memory and the affective conditions of grade stress, absence of humor, and little discussion. The scales associated with the language arts (divergence) side of the dimension have to do with the cognitive objectives of interpretation, evaluation, synthesis and translation; affective processes include student independence and participation in discussion (p.253).

In addition, mathematics classes were generally perceived by students to be "unpleasant". These findings are strikingly similar to those reported by the Texas junior high school study (Evertson and Brophy, 1977) and by

Good and Grouws (1977), even though these two research teams obtained their data from studies of teachers' behaviors while Walberg's data came from students' reports. This convergence of results from widely differing studies is encouraging, and it helps to support Walberg's 1974 assertion that students' points of view or perceptions of classroom processes are not only accurate but also may be important and more productive as research variables than are achievement measures or grades.

More convergent results have come from other studies of pupil behavior using instruments such as Spaulding's C.A.S.E.S. (e.g., Spaulding and Papageorgiou, 1975), an observation schedule designed to examine how children cope with life in the classroom. However, here much of the convergence results from the overlap of definition of categories — obviously the behavior called "attention to task" has both teacher and student components. Therefore, it is gratifying, although not altogether surprising, to find that just as "attention to task" is one of the direct teaching behaviors most often correlated with achievement, "attending" and "task-oriented" are student behaviors found to be correlated with achievement (Lahaderne, 1968; Cobb, 1972; Samuels and Turnure, 1974; McKinney et al, 1975).

Teacher Expectations

Good's contention (1977) that low achievement "produces" direct teaching introduces another complex and much studied inferential variable, that of teacher expectations or what is commonly called the Pygmalion effect. In its simplest form the Pygmalion effect is the product of a teacher's expectations of a child's behavior influencing

the teacher's behavior towards the child, the teacher's perceptions of that child's behavior, and the actual behavior of the child as he or she responds to the teacher's expectations, which then become a set of self-fulfilling prophecies.

Since Rosenthal and Jacobson (1968) published the original "Pygmalion" findings that teacher expectations actually influence student achievement, both the effects of expectations and the formation of expectations have been extensively studied. The controversy over the original study and the existence of the Pygmalion effect still rages. However, Rosenthal (1973) claims that not only has the expectation effect been shown to exist, but also that it has been found to vary with sex, age, ethnicity, SES I.Q., and even appearance, and that it affects the performance of swimmers, air force cadets, workers and even rats as well as the achievement of school children.

That teachers do indeed form expectations and act on those expectations now seems to be incontrovertible, even if the process of the formation of expectations and their specific effects is less accepted. In most classroom situations the teacher's expectations come from reports of previous performance -- either from a pupil's records (e.g., I.Q. scores, ability test scores, standardized achievement scores, grades) or from verbal reports from counsellors or other teachers. Very few teachers start the year with an "unknown" class.

Even cultural myths can be translated into expectations. Most elementary school teachers believe that boys will be more aggressive and troublesome than girls and then find them to be so; and that girls will learn to read more readily than boys, which they then tend to do (Rosen-

thal, 1973; Palardy, 1969; Doyle, Hancock and Kifer, 1972). In another study of the formation of expectations, Good and Dembo (1973) found that teachers have in advance quite fixed ideas about the percentages of students who will perform well, adequately, or poorly; who will answer questions well; and who will cause discipline problems. Accordingly they have strategies to deal with these preconceived situations. However, as a study by Wang (1973) shows, teachers (even master-teachers) are not particularly accurate in their predictions of student performance.

Once they are formed, do expectations affect teacher behavior, and if they do, in what way? Jeter (1973) states that there is "evidence at least that teacher expectations affect the way they interact with pupils". High achievers are asked more and harder questions, are given longer to respond, and get more praise. Low achievers are asked easy questions and are rarely pushed or probed for an answer. When a teacher was confronted with such a situation in her classroom, she reacted by saying that she supposed she did not expect the lower achievers to be able to answer anyway (Rosenthal, 1973).

While there is general agreement on the differential treatment of pupils based on expectations of achievement, the findings for differential treatment according to sex, ethnicity, and SES, although persuasive, are sometimes contradictory (Jeter, 1973; Dunkin and Biddle, 1974; Sayavedra, 1976; Charters, 1963). Given the trend toward complex interactions of contextual, presage and process variables, which appears to be emerging from research into the effects of schooling, these contradictions are to be expected. SES and ethnicity are the variables most often studied, but unfortunately, both variables, together with other

possible matching variables such as aptitude, are rarely controlled in the same study. The literature on the perception and treatment of poor and minority ethnic group children is large, but much of the data is anecdotal and much of the discussion is polemical. Where quantitative studies have been carried out the results have been mixed, although some evidence of an expectation effect is generally present. As we have suggested these mixed results may be in part a consequence of the interaction of ability, SES, and ethnicity. Sufficiently large numbers of low SES children are also from minority ethnic groups and are low-ability, low-achieving students, so that it may be difficult to distinguish between a ranking of expected performance said to be based on ability and one based on perceptions of SES or ethnicity. In other words the "disadvantaged" syndrome of low SES, minority ethnic affiliation, and low achievement may itself be the determinant of teachers' expectations. This interpretation raises the ideological argument that expectations based on social class (or a social "syndrome") are a mechanism for preserving and perpetuating social and racial inequalities. Thus, a political dimension is added to the interpretation of the research data. As with all controversial subjects, there is a tendency to frequently re-analyse and reinterpret this data (e.g., Bredemeir, 1975; Williams, 1976). Thus, although ethnicity and SES have often been lumped together in such studies, those studies in which ethnic affiliation was the main context variable have produced some striking results.

For example, although Oliveira (1970) found no significant differences between the ways in which teachers interacted with Anglo-American or Mexican American children, in a large federally funded

survey Jackson and Cosca (1974) found that Anglo-American children were overwhelmingly favored over Mexican American children, whom they described as being "neglected". Gay (1974) reported similar findings for black children.

In a parallel study designed to examine teacher expectations and teacher behaviors with respect to ethnic groups of students and the ethnic affiliation of the teacher, Sayavedra (1976) found that although teachers' rankings of expected performance did not appear to be based on ethnicity, there was indeed a difference in the way that teachers interacted with students which was related to expectations of performance and to ethnic group. Teachers who had ranked students on the basis of their expectations of achievement were divided into two groups -- Anglo-American and Mexican American. Actual achievement was not measured; rather the goal was to see if teachers appeared to respond differentially to their expectations of students' performance and/or students' ethnic affiliation. Results showed that both groups of teachers behaved differentially according to their expectations of the students' ability and one group of teachers behaved differentially according to students' ethnic affiliation.

Both Anglo-American and Mexican American teachers favored the students from whom they expected high achievement over those from whom they expected low achievement, but only Anglo-American teachers consistently favored one ethnic group, the Anglo-American students. For Anglo-American teachers, a strong ethnicity effect was found in the four comparison groups. Thus, Anglo-American teachers favored both the Mexican American and Anglo-American students from whom they expected

high achievement, but they favored "high expectation" Anglo-American students over "high expectation" Mexican-American students and "low expectation" Anglo-American students over "low expectation" Mexican American students. Sayavedra (1976) concludes:

> The classroom behaviors of Anglo-American teachers may well be influenced by pupils' ethnicity to a greater extent than classroom behavior patterns of Mexican-American teachers (p.99).

As well as reinforcing studies that show teachers acting on expectations of students' ability, Sayavedra's study also shows the complexity of interactive effects. A simpler analysis of the data, one that did not control for ethnicity, would have resulted in a single strong (expected) achievement X teaching behavior interaction and it would have masked the effect of ethnicity.

The general conclusion seems to be that there <u>is</u> a Pygmalion effect. After all, it would be difficult for teachers not to form some expectations of their students, and once those expectations are formed they may harm (or help) students' cognitive development. In the careful words of the Rand Corporation analyists (Averch et al, 1974):

> It appears that expectations probably influence teacher and student behavior and may influence measured student achievement.

High expectations, unless they involve unattainable goals, generally promote higher achievement, while low expectations usually are fulfilled as well. So, why do teachers not form the highest reasonable expectations for all their students? Some do, of course -- even those who teach disadvantaged, low-ability students (e.g., see Brophy and Evertson, 1976; Gigliotti and Brookover, 1975). However, at best many others peg

their expectations at the level of past performance. In this way students who have done poorly in school are expected to continue to do poorly and begin to behave in a manner congruent with those expectations (Rosenthal, 1973). Probably expectations also play an important role in the development of a child's sense of control of his environment, which is in turn related to achievement (e.g., see Gigliotti and Brookover, 1975; Brookover et al, 1973; Parent el al, 1975).

Whether low achievement leads to direct teaching and/or low expectations by teachers, or whether the preconceptions of teachers help to shape some pupils' behavior and lower their achievement, it seems desirable to have a "match" between teacher expectations of ability, SES, ethnicity and so on, on the one hand, and students with those characteristics, on the other hand. As long ago as 1967, Thelen is reported (Averch et al, 1974) to have found that teachers recognize four kinds of students -- good, bad, indifferent and sick -- and to have proposed a method which involved "assigning students to teachers according to the kind of student the teacher works with best" (p.64).

Pupil Characteristics

It is no surprise to find that ability or achievement is commonly cited as the basis for teacher expectations, since these measures also appear to be the best predictors of further achievement and must be carefully controlled when classroom effects are being examined (e.g., through the use of residual gain scores). Just as high expectations tend to promote higher achievement, high achievement tends to predict and promote continued high achievement, and low achievement promotes

continued low achievement (e.g., Keeves, 1975). Several linked presage and/or context variables can have an additive effect on achievement, thus creating a problem for the school, which can only try to act on the immediately perceptible problem. For example, children from low SES backgrounds who receive little verbal training or reinforcement from their parents develop I.Q. slowly and, since reading ability is correlated with I.Q., often learn to read late. By then they may have been labelled as "low achievers", and the cycle of self-fulfilling prophecy has begun. For not only is reading ability a good predictor of success in English (Gunderson, 1971), but it also may be a good predictor of success in other subject areas (Hunkins, 1969).

Such large-scale intervention programs as Headstart in the United States have attempted to break this chain of events, and they have shown that the chain can be broken under optimal conditions. For example, startlingly high gains in I.Q. can be achieved (Beller,1969; Averch et al, 1974). Unfortunately, the remedial effect of such early interventions may be diminished or even lost in later years unless continued support is provided (Averch et al, 1974). Here again, however, the interactions appear to be complex, involving at least the type of intervention and teaching method, and the characteristics of the child (probably including maturational factors). Beller (1969) for example, reports a delayed effect for pre-kindergarten interventions, with Headstart gains only showing up one or two years after the child begins school. Thus, the effect of the intervention may not show up uniformly in achievement scores at any one time and may tend to be underestimated. Several studies (Rosenshine and Furst, 1973; Averch et al, 1974; Hunt

and Hardt, 1976) show that the low SES children in Headstart or similar programs make greater gains in more highly structured classrooms than in those with low structure.

> Pupils from the more disadvantaged S.E.S. backgrounds tend to show greater progress in more highly structured programs (Averch et al., 1974, p.143).

This conclusion from the evaluations of pre-school programs is similar to that reported by Brophy and Evertson (1976) for low SES grades 1 and 2 students and by Rosenshine (1976) in his review of recent process-product research. (See Part I) Equally convergent are the teaching behaviors reported by Rosenshine and Furst (1973) as being significantly correlated with student gains in Headstart programs.

> Extent to which teachers required 100% response from all students. Extent to which the teacher corrected errors by repeating the entire task and testing the child to be sure that he could then make the correct response and extent to which the teacher followed the specified lesson format (p.128).

The last behavior was much less common than might have been expected, especially in highly structured programs, and may well help to account for the generally disappointing results obtained from other compensatory education project studies and from studies of the effects of curriculum packages or experimental studies in which a curriculum treatment is the main effect. Reviewing evaluations of curriculum materials, the Rand Corporation analysts (Averch et al, 1974) note some interactions between student ability and curriculum and comment that:

> Oftentimes differences between these curricula and conventional ones are small and sometimes results favor the conventional ones (p.67).

Similarly inconclusive findings are voiced by Macdonald and Clark (1973) with respect to objectives and curricula, by Della-Piana and Endo (1973) about reading research, and indeed, by all recent reviewers of subject matter or curriculum materials research. (See Wallen and Travers, 1963.) There is also a realization among curriculum researchers that many variables interact with a curriculum treatment and often mask some of its effects. As early as 1963, Getzels and Jackson had pointed out that:

> Variations in the teaching situation from one school to another may exist in such factors as educational viewpoint, nature of the student body, conditions in the community related to teacher status, and so on, but little provision is made for taking into account, such situational variables in the experimental results (p.575).

Once again, there appears to be a need to match curriculum materials with characteristics of the teacher, teaching method, and student characteristics. It may well be that, just as most researchers into teaching have abandoned the quest for a universally effective teaching method (or even a set of teaching behaviors), so curriculum researchers will have to give up the search for a universally effective curriculum.

Even where a particular cognitive approach or style has been built into a curriculum or program of studies evaluations of those progams have been generally inconclusive. Examples include "reflective" social studies programs (Metcalf, 1963), and discovery or process approaches to science (Thomas and Snider, 1969; Oberlin and Sanders, 1973; Anderson et al, 1975; Eggleston et al, 1976).

Almost equally inconclusive have been studies of cognitive styles or aptitudes or intellectual biases in learners (Yeatts and Strag, 1971;

Houtz et al, 1973; Gray and Knief, 1975; Satterly, 1976). That such qualities exist, however, seems to be generally accepted as also are the effects of aptitude-treatment interactions. What the nature of such aptitudes are, how they are formed and how they affect learning are not clear. The research, much of which is experimental and has little or no classroom application, has produced mixed results. Some workers (e.g., Field and Cropley, 1969; Walters and Sieben, 1974; Eggleston et al, 1976), especially in science and mathematics, claim distinctive intellectual bias or styles among high achievers in these subjects, while others (e.g, Ripple, Millman and Glock, 1969; Cronbach and Webb, 1975) find no differences, especially among young subjects. Other studies (e.g, Williams et al, 1971; Marjoribanks, 1976) report interactions of sex, attitudes, ability, achievement and subject matter, suggesting that aptitude-treatment interactions are complex. Finding this research generally unconvincing, the Rand Corporation analysts conclude:

> There is no conclusive evidence for an interaction between any special ability and educational factors, although there are some indications that these interactions exist. However, general intelligence is substantially correlated with ability to learn, especially for abstract and complex material; and in addition, there is preliminary evidence of an interaction between intelligence and educational treatment (Averch et al, 1974, p.97).

The same reviewers then quickly go on to point out that ability (I.Q.) grouping has never produced consistently higher gains than other kinds of groupings.

Since there is almost no end to the student characteristics that could and have been used to group children, either in classrooms or in

research designs, and since many of these characteristics have been shown to interact, some workers have concluded that optimal learning can take place only in an individualized setting.

Mastery Learning

A variety of approaches to individualization have been taken, including the incorporation of individual work into otherwise traditional classrooms through the use of work sheets, interest centers or study carrels; programmed packages; completely programmed curricula or audio-tutoral systems; non-graded schools; and mastery or criterion-referenced learning situations. The optimism that accompanied the development of programmed instruction in the 1950's and 60's has not been maintained by convincing research results (e.g., Flynn, 1969; Gallagher, 1970; Noble, 1969; Averch et al, 1974; Tobias and Ingber, 1976), and there continues to be intense debate over the behaviorist theories underlying the system as well as the social effects of such technologies (e.g., Travers, 1973; Glaser and Cooley, 1973).

Equally inconclusive have been the evaluations of schools or school systems using complete systems of individualization (e.g., I.P.I., the Trump Plan, Project Plan) and of the effects of the reorganization of teaching and administration that they require (e.g., Glaser and Cooley, 1973; Della-Piana and Endo, 1973). The organization and administration of such systems is so different from that of conventional schools or classrooms that often operating problems reduce the effectiveness of the programs (Averch et al, 1974; Coombs and Kessler, 1971).

Individualization as practiced in informal, open, or non-graded schools has proven to be even harder to evaluate because of the great variation in practices and methods and even in definitions of what constitutes "non-gradedness", or openness, or informality (e.g., McLoughlin, 1971; Dreeben, 1973; Groobman et al, 1976; Allen, 1974; Small, 1975). Further, just as the early research into the effects of indirectness or democratic teaching was based on a value position or "commitment" (Dunkin and Biddle, 1974), so does the support of non-graded or informal schools reflect a commitment to certain values rather than an attempt simply to seek efficiency in student achievement.

Individualized instruction, in addition to representing optimal pupil grouping, also is considered by some researchers to be the most efficient or productive use of time; that is, time spent in learning tasks, but not necessarily time spent at school (Husen, 1972; Karweit, 1976; Bloom, 1974; Harnischfeger and Wiley, 1976). Indeed, time can be considered to be the major contextual learning variable in individualized or mastery learning (e.g., Carroll, 1971; Bloom, 1974, 1976). If differences in aptitude or ability (which seem to be the best predictors of learning) are viewed as representing differences in the time students require to learn a particular concept or reach a specified criterion, then when variable time is available as required, all or most students should be able to achieve the levels of learning which are considered sufficient. Instead of variability in the outcome measures of schooling (achievement) there would be variability in the time spent reaching those outcomes. The contention that, given the time and the support (e.g., corrective feedback and reinforcement), all students can learn

all that schooling requires of them is powerfully argued and documented by Bloom (1974, 1976) and Block (1971, 1973, 1974). Clearly, mastery learning also involves a "commitment". As Block (1971) writes:

> Mastery learning is both a philosophy about schooling and an associated set of instructional strategies whereby the philosophy can be implemented in the classroom (p.130).

In their books Bloom (1976) and Block (1971, 1974) describe research which shows that all or most students in mastery learning programs not only reach criterion but do so with increasing speed, so that they appear to become more effective or efficient learners as they progress. Not only do they learn, but they learn how to learn. As they successfully complete units or lessons, previously unsuccessful students or low ability students are reported to spend progressively more "learning" time on the tasks of the units; that is, more time attending to the learning tasks, and thus becoming more efficient at completing them. After some time in such programs the differences in completion time between the fastest and the slowest learners narrows considerably, from a ratio of 5 to 1 to a ratio of less than 3 to 1 (Block, 1971, 1974; Bloom, 1976). These authors also report that in mastery learning classes up to 90% of the students have achieved as well as the top 20% of non-mastery students. Indeed, since aptitude is equated here with the time needed to reach criterion, individual differences diminish under mastery learning conditions wereasin conventional classrooms where individual differences increase during the course of schooling.

An attraction of this approach is the reduction in the number of interacting variables. As Harnischfeger and Wiley (1978) state: "The

amount of time spent actively learning, and pupils' characteristics, including their cognitive capabilities, are the sole proximal and distinctive determinants of achievement" (p.1) since time, instructional sequence, and the feedback reinforcement system are the three principal elements of the learning process that need to be matched. Hence, if the quality of instructional materials is high (e.g., if objectives and instructions are clear and appropriate) and the feedback (and correction) procedures are accurate, most students can be expected to reach criterion even in conventional classrooms where a good deal of group instruction still takes place (Block, 1971; Bloom, 1976; Peterson and McBrayer, 1976). Another attraction of mastery learning could be the fact that it is applicable to conventional classrooms, without any need to reorganize and administer a whole school system operation (e.g., Stillwell et al., 1972; Papalia and Lampogna, 1972; Peterson and McBrayer, 1976).

In focussing upon time and in particular upon time spent in learning and upon immediate corrective feedback, the proponents of mastery learning reinforce the findings of those process studies reviewed in Part I in which "attention to task" and "immediate feedback", together with variables related to clarity of directions and instruction, are the variables most highly correlated with achievement (e.g., Rosenshine, 1976; Brophy and Evertson, 1974; Good and Grouws, 1977). Also reinforced by these results are the teaching behaviors identified by Rosenshine and Furst (1973) as being effective in Headstart classes. The additional element here, central to individualizing instruction, is that

those processes are designed to bring each student to criterion before proceeding to further learning.

Adding incentive to the criterion referenced instructional model, in the form of days off of other tangible rewards, and stressing the conditioning or behavior modification aspects of controlled learning through systematic contingency reinforcement, the proponents of precision teaching claim that it produces significantly higher achievement than does "traditional" teaching (Breuning, 1978). Unfortunately, separating the incentive effect from the instructional effect in such studies can be difficult and, as Brophy (1978) points out, the use of "incentives" raises serious philosophical issues.

Summary and Conclusions

This paper has not attempted to review all the research using contextual variables that has been reported, but has tried to describe work which has shown interactions and convergence with the process variables reviewed in Part I. The variables reviewed can be summarized as follows.

1. Classroom Climate

   a. Classroom climate is a high inference variable which is difficult to define (i.e., operationalize) and to assess. Its relationship to achievement is complex, depending on student characteristics such as age, ability, motivation, and anxiety, as well as type of learning involved and other context variables. Classroom

climate then is both the product of interacting variables and an interacting variable itself.

b. The measurement of classroom climate or learning environment from student perceptions has resulted in findings for subject matter and grade level differences very similar to those reported from some process-product studies and observational studies of student behavior. The use of student perceptions or the "student's point of view" coupled with the concept of learning environment seems to provide a productive research strategy.

2. Teacher Expectations

a. Teachers have, or develop, expectations about how students will behave and in what way and how much they will learn, and these expectations influence their classroom behavior and may influence student achievement.

b. Often expectations are formed on the basis of perceived or previously demonstrated ability and may also be influenced by sex, SES, and ethnicity.

c. Low teacher expectations may well be one of the forces tending to perpetuate the cycle of low SES, low ability, and low achievement which tends to reinforce social stratification.

3. Student Characteristics

a. The relationship of SES and ability (I.Q.) to achievement appears to be strong, but it should not be accepted deterministically since programs of intervention (such as Headstart) have shown

that early disadvantages can be compensated for where support is adequate.

b. Student characteristics appear to interact in complex ways, singly or severally, with many other context and process variables. As a consequence, grouping of students by one characteristic (e.g., age, ability) has not been shown to sufficiently reduce the variability due to other interactions to produce consistent correlations between the grouping variable and achievement.

c. Cognitive styles, intellectual biases, or aptitudes appear to exist, but no consistent relationships to achievement have been reported, and this area of research has not yet yielded productive results. Aptitude-treatment interactions probably do occur, but within a complex web of other interacting variables.

4. Curriculum Materials and Programs

a. Evaluations of new programs or experimental curriculum packages fail to show that they have any consistent advantage over conventional or traditional curricula or materials. Often differences in objectives and/or content make comparisons of curricula partially or wholly inappropriate, and the presence of many uncontrolled or uncontrollable variables makes significant differences difficult to obtain and, when obtained, difficult to interpret.

b. Programs or materials based on advanced technology, such as programmed instruction, computer-assisted instruction, audio-tutorial systems and including laboratory-oriented science programs and T.V. instruction, show no pattern of achievement gains (or

attitude gains) over traditional materials (Chu and Schram, 1967; Sullivan et al, 1976).

c. There seems to be a growing realization that no one curriculum will be equally effective with all students in all classroom situations. Programs containing explicit teaching strategies, activities, questioning sequences, and tests have not resulted in higher achievement gains than those that leave a great deal of interpretation and preparation to the teacher.

5. Individualization

a. Mastery learning seems to be the most promising method of individualizing instruction that is currently being studied.

b. If individual differences are viewed as differences in the time required to reach a given criterion, all or most students, given sufficient time, can be expected to achieve the prescribed cognitive outcomes of schooling.

c. Given a good match of instruction and corrective feedback, the differences in time required to reach criterion can be diminished as the efficiency of learning increases. This is contrary to the normal process of schooling during which individual differences increase and, for most students, the efficiency with which they learn remains the same or decreases.

Although we must conclude that, like the process variables reviewed in Part I, context variables have thus far yielded little in the way of general "laws" of teaching or learning that could be applied to public education, we have begun to learn more about the nature of some of these

variables and the complex way in which they interact with each other and with presage and process variables. Indeed, the results of some of these interactions converging with similar findings from the process-product research reported in Part I provide our best current knowledge of contextual effects and the most potential for future research.

For example, the work of Walberg and his associates, which by focussing upon student responses in some ways projects a mirror image to the observational studies of teacher behavior, has produced findings similar to those reported from process-product studies, for subject matter differences (mathematics and language arts), and to a lesser extent for grade level differences.

Teacher expectations seem to enter the schooling equation in several ways. They may be reflected in differential behavior towards groups or subgroups within a classroom, or, as in the case of whole classes (or schools) of low SES and generally low ability children, they may be reflected in a generalized style or approach. Some convergence with the results of the Texas studies in low SES (Title 1) schools is suggested by the latter findings. The profiles of the effective teachers of low SES classrooms that are described by Brophy and Evertson (1976) in the Texas study, include several characteristics that imply a high degree of acceptance and reasonably high expectations of these students. On the other hand, the profiles of the less effective teachers indicate that many of them have low expectations and correspondingly little concern or esteem for the students. Walberg's studies, and indeed many others, have shown that students can be accurate assessors of the affective and cognitive climate of their classroom, so it would seem

that the need is to match low SES or low-achieving students with teachers capable of maintaining high expectations. Although it is not possible to state with certainty that low teacher expectations lead to lower pupil achievement, it does seem likely that they do encourage the maintainence of low achievement, especially among lower SES or minority ethnic group students. It is this probability that leads to the polemical or political nature of much of the discussion surrounding these and similar data. High expectations and the attitudinal and behavioral characteristics associated with them may not increase achievement, but low expectations and their associated syndrome certainly will not increase achievement.

Since the teacher characteristics reflected in measures of their expectations may not be very tractable, individualized instruction in a mastery learning format may provide a technique for reducing their impact. The results published so far do indicate that mastery learning can work, not only to increase achievement, but also to increase learning skills themselves. The learning skills are very important since future learning depends upon them. The goal of diminished individual differences as the outcome of schooling need not be seen as totalitarian nor as a levelling down if we remember that we are talking about mainly cognitive objectives of schooling, especially basic skills, not the whole range of the outcomes of education. In a democratic society definitions of the latter must allow for divergence and pluralism and cannot be prescriptive. However, as long as the limitations of defining some part of schooling for a specific end product are accepted and as long as we do not allow ourselves to be governed by the industrial model

implied in the en-product metaphor, mastery learning or synonymous systems such as performance-based or criterion-referenced education may indeed provide effective instruction in many situations.

So context variables, expecially student characteristics, are important in learning, but the published research shows that no single variable (with the possible exceptions of SES and ability) nor well defined set of variables is universally correlated with achievement. Research for generic interactions or relationships must continue at the same time as we recognize the uniqueness of each classroom, school, school district, or even national situation.

In order to begin to evaluate the type and amount of research carried out in Canadian schools and the nature of the results obtained, a brief summary of some of that research is presented in Part III.

PART III

RESEARCH IN CANADIAN SCHOOLS

The following short review is less exhaustive than those in Parts I and II. Although this section is not comprehensive, it is hoped that the studies reported are representative of Canadian research.

The largest number of published Canadian studies are found in Canadian journals such as the Alberta Journal of Educational Research, the Canadian Journal of Education, and Interchange. A lesser number appear in American journals such as the American Educational Research Journal, and still fewer appear in British journals such as the British Journal of Teacher Education. Other studies are found in the house publications of institutions such as the Ontario Institute for Studies in Education and provincial departments of education. Finally, the largest number of studies listed in the yearly Directory of Education Studies in Canada are unpublished Master's theses and doctoral dissertations. A search of titles listed in the directories for the last five years revealed that few studies -- less than 5 percent -- appear to be related to the school-based elements of achievement that have been the subject of this review. Thus, as is the case in the United States, the total amount of research which relates process and product variables to context and product variables is small.

A Five-Year Summary

Since most titles listed in the yearly bibliographies were unpublished studies, it was decided to base the present review on those

published studies which appeared in the five most recent volumes (years) of major Canadian educational research journals. In addition, the long-term projects of three Canadian research centers are described, using papers presented at the 1978 Annual Meeting of the Canadian Education Research Association. Clearly long-term studies are very important and are representative of the best of current Canadian educational research.

The Alberta Journal of Educational Research was found to be the best source of relevant studies, but the Canadian Journal of Education and Interchange were also useful. Some journals, such as the McGill Journal of Education, almost exclusively contained theoretical articles, while others (e.g., Orbit) seemed directed to teachers, with articles containing program and curriculum information, lesson ideas, and anecdotes.

Notes were taken on 25 of some 420 articles appearing in the last five volumes of three main journals, and an additional five articles were gleaned from a variety of other journals. These 30 studies form the basis of the present review. Some measure of achievement was an outcome variable in all 30 studies. Five studies related process variables to a variety of outcome measures; four related grouping variables; eight related pupil characteristics; three related classroom climate; two related teacher expectations; three related conceptual level; three related curriculum; and one related technology. Since the number of studies in each category is so small, no comparison of these results to findings from the United States can be usefully made. Rather, an attempt is made to relate the findings where it seems appropriate.

Of the six process-product studies, only one was comparable in scope to those reviewed in Part I. Its goal was to:

> ...study patterns of teacher behavior and student outcomes in two settings using curriculum materials based on alternative psychological learning approaches (Wideen, Kennedy and Bettschen, 1977, p.4).

In this study a curriculum variable was added to the teacher behaviors/student outcomes design of many process-product studies. The two treatments were designed to demonstrate opposing approaches to science teaching — one treatment was based on specified behavioral objectives (structured outcomes) while the other had an inquiry or problem-centered approach. A control group, to which no science was taught, also was included in the design. No significant differences were found in achievement between treatment groups, but both treatment groups showed significantly lowered interest levels than did the control group. Apparently instruction in a subject lowers one's interest in it, or perhaps one's curiosity. The researchers found great variation from teacher to teacher, even though the latter had been instructed in the methods they were to use through in-service training. In addition, the effects of that instruction appeared short-lived, as process measures showed teachers quite quickly reverting to habitual teaching behaviors. Although six process variables that distinguished the two treatment groups were found, they all defined the inquiry or "cognitive restructuring" approach. Rather than simply concluding, as many curriculum studies do, that the treatments produced no significant differences (e.g., Wideen, 1975) the researchers concluded that the teacher variability in process measures and the very short-lived effects of the in-

service training made a treatment effect very unlikely. This conclusion again underlines the need to use teachers whose behaviors have been shown to be consistent over time and to seek out teachers whose teaching styles already approach the desired behaviors. Perhaps for similar reasons Briggs and Evanechko (1976) found that teachers trained to teach elementary language skills through inquiry methods did not produce significantly higher reading and listening skills than did teachers using conventional methods. However, here we should note the contention reported in Part I that inquiry style methods may be inappropriate or irrelevant to learning the basic skills in the lower elementary grades (e.g. Brophy and Evertson, 1976).

By means of independent, observational ratings Robitaille (1975) selected 25 highly effective and 30 minimally effective mathematics teachers out of a sample of 167, and then had principals judge classroom personality by choosing from six categories, three positive and three negative.

> All 25 effective teachers were assigned positive categories with over 80 percent being rated as responsible, businesslike and systematic in their teaching. Over 60 percent of the ineffective teachers were assigned to negative categories (e.g., dull-routine) (p.303).

Although the principals' judgements were subjective and lacked operational definitions, the profile of the effective mathematics teacher as being businesslike and systematic does correspond to the results of the process-product studies described in Part I (e.g., Good and Grouws, 1977) and the learning environment studies reviewed in Part II (Walberg, 1974). The Canadian study carried out by Boak and Conklin

(1975), which is reported in Part II, provides more anecdotal support for this picture of the mathematics teacher. Several mathematics teachers in this experimental study of interpersonal skills indicated that they felt the requirements of teaching mathematics "inhibited" them from being concerned with students' personal experiences, and that this made them appear more businesslike.

In a study matching teacher directiveness and student authoritarianism in relation to grades and satisfaction, McCann and Fisher (1977) found that with regard to grades there was a clear match between students' level of authoritarianism or dogmatism and their perception of the teacher's directiveness. That is, "non-authoritarian or non-dogmatic students earned higher grades when they perceived the teacher to be non-directive; authoritarian or dogmatic students earned higher grades when they perceived the teacher to be directive."

The students' perceptions were critical, since when the actual degree of teacher directiveness was controlled the relationship fell below significance. Student satisfaction showed a similar matching effect which remained significant when actual directiveness was controlled. This interesting study, which parallels some of the conceptual level research reported later, also reinforces Walberg's contention (1974) that students' perceptions are a critical "outcome" measure.

Walberg's (1974) contention that classroom climate as measured on the Learning Environments Inventory makes a significant contribution to achievement receives support from a study of mathematics classes in Ontario (O'Reilly, 1975). Forty-eight Grade 9 and Grade 10 classes

comprising a total of 1,100 students were used in ths study which found 10 out of 15 of the LEI scales to be related to achievement. High achieving classes were characterized by high scores on cohesiveness, environment, satisfaction, difficulty and democracy, and by low scores on friction, favoritism, cliquishness, disorganization and apathy. Even when researchers controlled the effects of some student characteristics or presage variables which have been shown to be strong predictors of achievement (such as dislike for schooling or parents' education), classroom climate remained significantly -- although less so -- related to achievement. O'Reilly (1975) concludes that:

> Although pupil personal and social characteristics are important correlates of achievement, climate in some instances is a more important factor (p.247).

In a rare replication study Anderson and Walberg (1972) used 61 Montreal classrooms along with previously collected United States data to study class size, learning environment, and physics achievement. Only two out of eight previously significant findings were reported in the new study, which led the authors to comment:

> In conclusion, replication studies are generally difficult and seldom attempted by researchers. But, if replication and generality cannot be established or is unpromising, then it will not be possible to apply findings from one setting to any other. We suspect that educational research, in general, will have to be replicated across all kinds of background variables before it can be very relevant (p.285).

However, in another study of Montreal classrooms Walberg and Anderson (1975) found that 12 of the 15 LEI scales were significantly related to overall achievement -- a result similar to O'Reilly's (1975).

The effects of teacher expectations on process and on product measures have been described in Part II, and an experimental study carried out in Alberta (Therrien, 1976) serves to reaffirm the importance of this variable. Investigating the effect of the order of presentation of information on the formation of erroneous expectations, Therrien (1976) found that "first impressions" were both strong and durable:

> In all instances the data support the notion that the subjects' final attributions are influenced by their initial impressions (p.211).

This finding that the "primacy" effect was stronger for the child-pupil used in the study than for the adult-pupil implies that elementary school teachers may be even more highly influenced by first impressions of pupils than are high school teachers. Given the self-fulfilling nature of the Pygmalion effect, the results of this study again indicate the need for matching elementary school children with teachers who have the most positive attitudes towards them and the highest expectations possible (Quarter, 1975; Williams, 1976).

The often-linked presage and contexual variables of SES, reading ability, and achievement in early school grades also has been noted in Part II, where most of the studies compared groups differing widely in SES; for example, comparing inner city or ghetto children with upper-middle class children. In Canada similar effects have been found in studies of native Indian or Metis children (Franklyn, 1974; Krywaniuk and Das, 1976). However, in a study carried out in Calgary, Rodgers, Slade and Conry (1974) compared the oral language competence of "aver-

age," urban Canadian children who were divided by parental occupation and income into high, medium and low SES groups. Groups which might be educationally disadvantaged, such as recent immigrants or racial groups, were deliberately excluded from the study. Yet even within this relatively homogeneous group the researchers obtained significant correlations between oral language competence and SES in grade 1, and between oral language competence and reading at the end of grade 2.

Oral competence would seem to be an important attribute in second language learning. McEwen (1976) found this to be so in a study in which she used a specially modified form of the Flanders Interaction Analysis System to discriminate between high and low achievers in a grade 11 French class. High achievers were found to talk more divergently than did low achievers, and they received more praise than the latter.

It was noted in Part II that cognitive style has not yet proven to be a very productive variable. However, the following study does provide another example of a matching effect among a pupil characteristic (cognitive style), a teaching style or learning environment, and pupil achievement. In this study Walters and Sieben (1974) found that higher achievers in elementary science showed a cognitive style characterized as "field independent" or analytical and were able to learn well in open, self-directed classrooms, while students characterized as "field dependent" or global in their cognitive style tended to show less ability in science and learned best in more structured classes. However, in an earlier study in which the interaction between teaching styles (dis-

covery versus expository) and cognitive styles in a ninth grade geography class was investigated, Grieve and Davis (1971) were not able to show any significant interactions. Also investigating science classes, Crocker et al (1977) report contradictory aptitude treatment interactions and general stability of teacher and pupil behaviors regardless of the amount of classroom structure or control.

> The results of the descriptive study strongly support the general conclusion that teacher and pupil classroom roles possess an inherent stability that does not fundamentally change even under an apparent drastic change in the surface features of the class setting (Crocker et al, 1977, p.162).

D. E. Hunt (1975), whose work on the working model of teacher and pupil conceptual level has been reported in Part II, sees cognitive style and the associated aptitude treatment-interaction research as being closely related to the conceptual levels he has established, and he feels they have been too readily discarded by many researchers. Nevertheless, the practical application of conceptual levels theory remains minimal. As Brophy and Good (1974) note:

> Of the variables studied, conceptual level seems the most promising as a basis for optimizing matching teachers and students. Even this work has not yet reached the level of practical application (p.269).

A conceptual level matching model was included in a component of the Teacher's College Columbia teacher education program (Joyce and Weil, 1972), with some success (Hunt et al, 1974).. Classroom studies have produced mixed results (e.g., Tukeman and Orefice, 1973; Allen, 1977). This led Allen (1977) to conclude that, "The fact that matching

students with programs did not result in more positive attitudes for students with relatively high conceptual levels remains puzzling" (p.63). While the theory of conceptual levels remains attractive, more research on its application and the evidently complex way in which it interacts with other school-based variables needs to be studied (e.g., Crocker et al, 1977) in order to refute the negative comment of Brophy and Good (above).

So, in the main the results from Canadian studies are similar to those reported in Part II on studies carried out in the United States and elsewhere. As further examples, we find that in a study of test taking (Bond, 1977) change in anxiety level was found to be a significant factor; open area schools showed few differences from self-contained classrooms (Traub et al, 1972; Allen, 1974; Small, 1975); individualized science classes showed few differences from conventional science classes (Griffiths and Crocker, 1976; Wideen, 1975; Crocker et al, 1977); and "live" classes were found to be consistently more effective than televised classes (Sullivan et al, 1976).

Views from Three Canadian Research Centers

Three research centers in Canada with ongoing, long-term projects -- Simon Fraser University, Memorial University, and the University of Alberta -- presented progress reports to a symposium entitled "Theory and Research on Teaching: Views from Three Research Centers" at the annual meeting of the Canadian Educational Research Association at the University of Western Ontario in June, 1978. Although the papers presented

were only progress reports and thus the results of the studies described are not yet published, a summary of the three papers will give an impression of the concerns and directions of some of the best current Canadian educational research.

1. Noting the generally "disappointing, inconclusive, and often unproductive" (Martin, 1978, p.3) results of teacher effectiveness studies to date, workers at Simon Fraser University see as one main culprit "educational research's almost exclusive reliance upon traditional methodological and theoretical paradigms" (p.4). Martin goes on to note that total frequency counts of teacher acts and their use as correlates of achievement or other outcomes yield only general associations which are "relatively uninformative" since they do not indicate the causes of the relationship or even the place (time) at which particular teaching acts occur in the sequence (lesson). To remedy these and other design shortcomings, the Simon Fraser researchers (e.g., see Martin and Auerbach, 1977; Winnie and Marx, 1977; Martin, 1978) suggest that new methodological and analytical techniques should be used in conjunction with conventional methods. To improve the strength of inferred causal links between teaching behaviors and outcomes, they propose experimental studies using intensive designs; and to provide more information about how teaching acts function, they intend to use time sequence analysis techniques with their observational data. Two pilot studies using these techniques are being undertaken with the objective of providing a rigorous experimental testing of some promising process variables by contrasting two instructional interventions, one

based on questioning strategies and the other on an operant-based classroom management strategy. The objective is to determine within these two instructional strategies the "exact temporal interactions between independent and dependent variables" and to test "the possibility of reciprocal determinism among, and multiple causal functions of, important teacher and student variables" (Martin, 1978, p.8).

2. While Martin and his co-workers see methodological experiments as a key to progress in educational research, the Institute for Educational Research and Development at Memorial University, Newfoundland is engaged in a three-year naturalistic study of elementary classroom teaching. Following a concern with teachers' perceptions of their instructional roles and strategies (Crocker et al, 1977), the focus here is on the antecedents of classroom behavior rather than just on process-product relationships. The study is designed to discover how teachers construct, use, and modify repertoires of strategies.

> The study is based on a model in which the teacher is seen as constructing a repertoire of strategies--generalized patterns of behavior--from her interpretation of antecedent conditions and from immediate and long-term feedback from classroom experience (Crocker, 1978, p.1).

In addition to noting the ways in which teachers form and implement teaching strategies, the study also will investigate just how these strategies are manifested in the classroom. This observational phase of the study should allow the researchers to determine: whether the observed classroom processes are congruent with the strategies expressed by the teachers, the nature and extent of feedback, how the feedback changes the teacher's strategies, and the relationship between teaching strate-

gies and student behaviors and outcomes including achievement. Reading and mathematics achievement will be measured in particular, which should allow comparison of the results of this study with those reported in Part I by Brophy and Evertson (1976), McDonald (1976a, 1976b), and Good and Grouws (1977).

3. The Centre for Research in Teaching at the University of Alberta is carrying out a large quasi-experimental study in cooperation with the Edmonton Public School district, also focussing on reading and mathematics in the elementary grades (Mackay, 1978). Using behaviors or sets of behaviors that have been defined in recent research and in the Centre's own studies as "desirable" or as recommended teaching strategies for teachers in an experimental group, the study will seek to examine three main questions:

a. Can short-term training have an impact upon the behavior of teachers in the experimental group?
b. Will there be substantial differences in the behavior of teachers in the experimental group as compared with those in the control group?
c. What impact will the recommended behaviors have upon pupil achievement in mathematics and language arts at the grades three and six levels? (Mackay, 1978, p.22).

Both the study of teachers' thought processes and the planned quasi-experimental study grew out of five doctoral studies that already were under way when the Centre was created in July, 1977 (Eggert, 1977; Fasano, 1977; Mahen, 1977; Marland, 1977; Muttart, 1977). This group research project, which was in part modeled after the Texas Teacher Effectiveness Study and the Stanford University Beginning Teacher Evaluation Study (see Part I) was supervised by Dr. Al Mackay and produced the following significant results:

a. A naturally induced expectation effect.

b. A marked effect of SES on both teacher and pupil behavior.

c. Strong support for direct teaching (i.e., narrow direct questions, immediate feedback and praise, and supervised small group work were consistently correlated with high achievement).

Summary

The most promising developments in process-product research in Canada are taking place in those research centers which have planned long-term projects such as those described in the C.E.R.A. papers.

That certain theoretical and methodological elements are common to all three projects is reflected by the common concerns expressed in all three papers. Recognizing the complexity of interactions among presage, process, and context variables, each group has adopted a methodologically sophisticated research design which is experimental or quasi-experimental and uses variables previously tested in other studies, especially in elementary mathematics and reading classrooms. In this way, comparisons can be made with the results of the large American studies, and these comparisons can help to answer some of the questions raised by the American studies. For example, is direct teaching generally effective in the elementary grades? Can naturalistic (correlational) studies be successfully combined or "translated" into experimental studies? Can teaching behaviors be durably modified or are they too much a reflection of variables such as information processing styles (thought processes),

expectations, or deeply held beliefs to be readily changed? Do Canadian teachers use the same behaviors in ways similar to American teachers? Do Canadian pupils act and react in ways similar to American children? Can process effects become significant enough to at least partially overcome such powerful non-school-based effects as pupil SES and I.Q.?

These Canadian studies, which seem comparable to the best "second generation" studies reported in Part I, are important research events. If they are to have their greatest effect, a network of cooperation and communication among the often widely separated research groups (called for by Mackay, 1978 is certainly needed. Only in this way will the work of these centers receive the recognition and support that it clearly merits.

PART IV

DISCUSSION

Reviewers and commentators on educational research have long pointed out the complex nature of schooling and the inter-relatedness of presage, context and instructional (process) variables; and have criticized research designs for not taking this complexity into account. Probably the causal factors in the "simple" (e.g., single variable or simple correlational) approach to educational research also are complex, but, as shown be some of the early process research that is reported in Part I, "commitment" to a theory or an ideology was a major motivating force. Since schooling is a valued and therefore value-based activity in our society, we cannot and should not expect values and ideology-based theory to disappear from research designs. It is probably undesirable to have the variety of such values replaced by a single value, efficiency. Clearly there are and should be limits to the means we are willing to employ to the end of higher achievement scores, and these limits reflect values that will continue to influence theory for discussion and testing. Here it is necessary to recognize the social context within which research takes place, for the research enterprise like all other social endeavors is greatly influenced by the principal ideas of the society and the social climate, the Zeitgeist of the society within which it operates. Thus, in some respects scientific research, especially in the social sciences, is as much a product of its time as is literature or art.

The clearest expression of social influence on research is found in the dominant ideas underlying the theories that are proposed to explain and predict behavior. Early process-product research that tried to establish the superiority of indirect/democratic/integrative teaching was much influenced by the ideas of the progressive education movement in the United States and the mental health movement with its child-centered, almost neo-Rousseauian, philosophy of child development. On the other hand, present research models reflect the dominance of the industrial and cybernetic models of thinking that have dominated North American society for several decades. Much current education talk has abandoned the metaphors of the child-centered movement for the metaphors of systems analysis with its lexicon of inputs, raw material, quality control, outputs, feedback cycles and accountability. Of course, the industrial model has been very successful in business and industry, so it is tempting to apply it to social processes like public schooling, which has become an area of high investment where returns upon that investment are largely intangible.

The present calls for accountability may reflect some uncertainty about the worth of such investments in a society grown used to measuring the value of investment by its tangible returns. A similar uncertainty can be seen in the calls for a return to the basics and to a simpler and perhaps cheaper version of schooling. It is perhaps not unwarranted to wonder if this present preoccupation with basic education is not related to current interest in the findings for direct -- or what many would call "old fashioned" -- teaching (reviewed in Part I). For example, "attention to task" or "time spent on task", which are teacher/student

variables currently receiving a great deal of attention and support, also were the objects of theory and research at the University of Chicago some 50 years ago (Judd, 1918).

In any event, recent trends in process-product research reflect a more systematic and pragmatic approach to this means-ends relationship and this approach is quite in keeping with the limited definition of "product" which has been adopted, that of short-term achievement gains. It is not surprising then that the claims made from the results of this research are more circumspect or probabilistic than are the claims of some earlier works. This research attempts to build a model of teaching from consistent relationships between sequences of teaching behavior and situational mixes of content variables, on the one hand, and consistent gains in pupil achievement on the other. As generic relationships are established, they can be translated into statements of probable cause and probable effect. This is necessarily a slow process and one which, at any particular time, may not appear to be very productive. If we add the low level of funding of educational research and the consequently low number of active researchers (by Rosenshine's account in 1976, only some 12 active individuals or groups) to this cautious "mix and match" approach we should not be disappointed at the limited and tentative nature of the conclusions to be drawn from current published findings. Nor should we be discouraged from continuing the search for these optimal matches of presage, process, and context variables. The hope remains that they can be established at a sufficiently general level to be useful information for policy makers, administrators, and classroom teachers alike.

The alternatives to the above strategy essentially imply that schooling has not been and will not be proven to be amenable to scientific methods; in other words, that the analytical and reductionist methods of science simply are not appropriate to education. Indeed, some researchers, noting the failure of past educational research to provide useful insights into the practice of schooling, have tried to apply paradigms and methods from other disciplines to the study of classrooms. Berliner's (1976) attempt to apply ethnographic techniques and interpretations to classroom interaction produced results disappointingly similar to those from process-product studies, while Eisner's (1968) provocative writings on the classroom as an aesthetic system remain untested and/ or untestable.

Still other workers (e.g., Rogers, 1969; Combs, 1965) see education as an enterprise dependent on human relations and define the critical variables of the enterprise in the same terms as are used to describe other helping or therapist-client relationships. The focus here is almost exclusively on the means of education, since there is an acceptance of the primacy of the processes involved and a belief that "good" means will produce "good" ends. "Take care of the processes of schooling and the products will take care of themselves," sums up this position.

At the other extreme from the scientific study of education is the belief that teaching is an art and, given the success of scientific paradigms in our society, this idea is rarely encountered nowadays (Brameld, 1973). This view, so well expounded by Gilbert Highet (1956), suggests that the ephemeral or creative nature of teaching is so central

to the practice of this art that when we analyse the act of teaching, we lose its essence. Other analogies are made with synergistic systems, in which the total system is more than the sum of its component parts, so that an analysis of the parts can never fully explain the total system; and with existential explanations (e.g. Greene, 1967) in which the teaching act itself is seen as the essential encounter. Obviously, case studies or descriptions of charismatic teachers, which are often the data in such work, do not lend themselves to generalization for a system of mass public education. Nevertheless, together with the strictures of what the Rand Corporation analysts (Averch et al, 1974) call the "reform writers", they remain extremely important as reminders that there are other ways of thinking about the problems of schooling.

The arbitrary division of educational research variables into three groups corresponding to three largely separate areas of influence and study also has guided our thinking about the structure of schooling and the forces determining school performance. As well as tending to encourage the separation of presage, context, and process variables into distinct research areas, which often proceed from separate disciplines with separate methodologies and little interchange, the separation has led to considerable debate and controversy over the relative importance of each category of variables. The debates reflect more than a simple academic squabble since economic and political decisions with far-reaching social effects often depend in part on the resolution of these arguments. If students of non-school-based effects can demonstrate, as they have tried, that school-based effects have little or no relation to achievement, then one conclusion that can be advanced is that less money

should be spent on those school-based activities; that is, on schooling itself (Averch et al, 1974). How much effect school-based variables have on achievement is not readily answerable from research findings because of variations in research designs and statistics. For process variables, this estimation of predictability varies from next to nothing (e.g., Heath and Nielson, 1974) to about 20% (e.g., Schutz, 1966), with most writers agreeing with Walberg (1971) that "instructional variables (as they have been recently investigated) typically make little difference in learning" (p.18).

One major reason given for the little impact made by instructional variables is the apparently overwhelming predictive effects of some non-school-based variables. As Walberg (1971) notes:

> Heredity and pre-school environment are such potent forces that the effects of instructional methods are minuscule by comparison. Even after school entrance, learning environments outside school such as the home and community are more long lasting, continuous, and pervasive than typical sequences of instruction (p.16).

Aptitude (I.Q.) has been shown to account for from 15% - 50% of the variance in learning; and measures of home environment, which include or are a proxy for some portion of the aptitude measure, can account for up to 64% of the variance in learning (Walberg, 1971). So it is easy to see the temptation to join with writers like Coleman (1966) in concluding that what happens in school makes no difference. However, as Walberg (1971, 1974) has shown, some school-based variables do add a significant, if smaller, amount of variability to the prediction of learning. Since these school-based variables are the ones that can most easily be manipulated, it does seem necessary to try to maximize their

effects through research and practice. Even the negative effects of some of those home-based variables that disadvantage a child before he ever starts formal school have been shown to be at least partly remediable by instruction (e.g., Headstart). Therefore, instruction cannot be of neglible effect. The problem is rather to determine just how effective instruction can become.

Certainly non-school-based variables greatly influence the predictability of achievement in school and limit the effects that schools can have on children in all domains and not simply in achievement. Perhaps the disappointment that such a realization often brings is a measure of the high expectations we have invested in schooling. There has long been a tendency to view the school not only as an agent of acculturation but also as one of social change and even as a panacea for social problems. The schools have been asked or have volunteered to resolve or mitigate intractable problems within our society ranging from racial and social inequality to pollution and drug abuse. Of course it is easier to include environmental studies in the curriculum than it is to stop industrial and public pollution; and it is easier to offer free lunches and remedial reading classes to children from disadvantaged homes than it is to change the existing social or economic structure. But we should not expect the greater social problems to go away, nor should we expect our research results to show that schooling can overcome the effects of such serious problems. Childrens' learning in school does not simply reflect the influence of teachers and schooling but also all the ongoing forces at play, at home and in society. Rather than lament-

ing the lack of effect which schools appear to have on some children, we should be intent on maximizing that effect, however small it may be compared to the effects of the out-of-school environment. Measures of the latter clearly are the best predictors of achievement in school unless one takes an extreme position on the inheritance of ability, just as they are the best predictors of performance in most other spheres of endeavor in our society. Acknowledging this is not to take a deterministic position but only to realize the limits within which schools can expect to influence the amount and type of learning that takes place. For example, schools can and do teach children to read as well or better than ever; however, schools cannot convince children to become regular readers in a society in which reading is no longer a generally practiced and valued activity. If children see, as they do, that adults around them do not read regularly, why should they believe an elementary school teacher who tells them that reading is the most important skill they ever will learn? Without social reinforcement the best the school can hope to do is to teach children to be literate, to decipher print and to write (e.g., see Flanagan, 1969; Karlin, 1969). In increasingly organized societies there is "an inevitable conflict in life style and outlook between the literate culture of the classroom and the oral culture of the street" (Sloan, 1973. p.258).

So, while one goal of research into school-based elements of achievement should continue to be defining the limits of what schools can do, research must continue on the assumption that what takes place in classrooms is of significance to present and future learning, and that there-

fore attempts to understand and improve the processes of instruction are themselves of significant worth.

Even those individual context variables that show most predictability for achievement (such as student SES) have been shown to interact quite strongly with other context and process variables. The best results obtained so far indicate that these interactions are complex and that the optimal match of teacher characteristics, pupil characteristics, teaching behavior, and classroom environment is likely to vary from school to school, from grade to grade, and from subject to subject. These "best" results show that teachers are able to produce gains sufficient and consistent enough to demonstrate that they do make a difference. Further, the teachers who are more effective in low SES classrooms have different characteristics and teaching behaviors than do effective teachers in high SES classrooms. Teachers of early elementary school grades, where basic skills are the principal objectives, may be more successful using "direct" or "task-oriented" methods, while teachers in upper elementary and junior high school grades expect more high-level cognitive skills. Subject matter differences become marked at the high school level, with mathematics teachers seeming more authoritarian (direct) and English teachers showing a more democratic style, encouraging independence and divergence, and appearing more approachable. Whether these differences reflect the structure and content of the disciplines or the characteristics of teacher candidates which predispose them to one or other teaching major is yet to be determined. Perhaps some of the most striking results can be summarized by stating

that, in terms of the single criterion of achievement, behaviors and/or environments that are designed to increase the time students spend actively involved in tasks closely related to that criterion are most effective (N.B. not simply time spent in school). This seemingly commonplace finding serves to point out one of the shortcomings of using short-term achievement gains as the only criterion of instruction. Walberg (1971) notes a similar "baneful banality" in many curriculum studies:

> Students in a new course score higher in tests based on the new content, while students in traditional courses score higher on traditional tests (p.16).

We have already noted that the logical end of seeking only efficiency of learning as the criterion of teaching well might involve teaching techniques inimical to democratic values. Drugs, intimidation, bribery, deprivation, brainwashing, and indoctrination have all shown themselves to be more effective than traditional classroom instruction in inducing short-term learning yet we would not sanction their use in our classrooms because we have tempered our desire for efficient teaching with beliefs about the right way to encourage such learning.

We therefore must be aware of these limits and their relationship to the other outcomes of schooling that we consider important, those which fall into the area of affective and social learnings. It may be that in some situations cognitive and affective goals are even mutually exclusive or at least at odds with each other. This implies a need to be selective about the outcome criterion that is stressed in any particular situation. The actual criteria of schooling (i.e., achievement,

attitudes) also may be considered to be elements of the optimal match that is being sought. For some students in some situations an affective criterion may be more appropriate than the cognitive one deemed suitable for other students. Indeed, several workers (e.g., Walberg, 1971, 1974) have argued that at any time students' feelings (attitudes) about learning are more important than actual measures of achievement, since these feelings about learning and about school in general will govern their future classroom performance. If we accept Walberg's data (1971, 1974) that student perceptions of classroom cognitive and affective environment are a more powerful predictor of future achievement than are instructional variables, it can be argued that the variable which can be manipulated, environment, should be the focus of our research, rather than its correlate, achievement, which can not be manipulated.

As the previous results show, process variables interact with presage and context variables, and their effects cannot be usefully considered as separate from them. The fact that variables from all areas enter the schooling equation to influence achievement is one reason why the multivariate approach to process research typified by the Texas Teacher Effectiveness Study and the Alberta studies under Dr. Mackay appears to offer the best chance of obtaining useful results. Equally promising is the position adopted by Walberg (1971) and his associates in attempting to integrate the three areas. Beginning the task of building a "territorial map of school learning" from Bloom's (1966) descriptors of 1) predictability of human characteristics, 2) the effects of the environment, and 3) instructional strategies, Walberg

(1971) notes with respect to the first descriptor that:

> Individualizing instruction (under one definition) depends on finding instructional treatments that are differentially effective for different learners (p.16).

Commenting upon environmental effects he says:

> Since 1966, a series of studies have demonstrated that student perceptions of the classroom learning environment can be measured reliably and that environmental measures are valid predictors of cognitive, affective and behavioral measures of learning (p.16).

He goes on to say:

> Moreover, powerful interactions have been identified between environment and both instructional variables (Walberg, 1969) and individual differences in aptitudes and personality (Anderson, 1968; Bar-yam, 1969) (p.16).

To Walberg (1971) these results require,

> ...the incorporation of individual differences and environmental factors into experimental designs for instructional research (p.16).

Although they have approached from a different direction, the work on mastery learning by Bloom (1966, 1974, 1976) and Block (1971, 1974) can fit into this framework since it too seeks an optimal fit between the individual, the environment, and instruction.

Studies of mastery learning and of environmental effects have produced some results that converge with those from some of the recent process-product studies. The two types of research appear to differ most with respect to the broad questions they seek to answer. The process-product studies of classroom behavior are looking for what works best in classrooms as they currently function, while the learning environmentalists, and especially the mastery researchers, are studying changes in present classroom functioning intended to maximize achievement.

Obviously both types of research are needed and obviously both are long-term projects that require careful planning, longitudinal replicated studies, and adequate funding. While descriptive and correlational observational studies continue to be needed, experimental or manipulative studies also are required to strengthen the findings of the correlational studies. The low number of such research groups, mentioned by Rosenshine (1976), mitigates against rapid results from the field, especially since short-term, unique studies remain the requirement for most graduate degrees. Such results can be expected only in the few institutions where research and development centers or particularly active researchers have been able to set up comprehensive, longitudinal programs into which graduate research projects can be integrated, such as Texas or Stanford in the United States and now the Centre for Research in Teaching at the University of Alberta in Canada

Too few researchers and too little financial support are not the only impediments to generating a large and coherent body of research data into schooling. Inadequacies of design and analysis are still noted in many studies as are the lack of controls, the small size of many samples, and the short duration of many studies. Few studies are replicated, and since there continues to be great disparity in the operational definition of many variables from study to study, comparisons often are difficult to make, and when made, easy to criticize (e.g., see Heath and Nielson's (1974) critique of Rosenshine and Furst's (1971) review of process-product research). Even different observational instruments which appear to be measuring the same behaviors may not in fact be doing so (Borich et al, 1977). Many of these technical

problems will continue to exist. For example, the development of new, more sophisticated observational schedules or rating scales will continue to make the data collected with them difficult to compare to the data collected on the older, "cruder" instruments. In Canada, circulation of research results may continue to be a problem since much work remains unpublished or is to be found only in universities or government departments. Excellent bibliographies of educational research are to be found in the yearly Directory of Education Studies in Canada published by the Canadian Education Association. The number of listings is impressive but there is no evidence of planned, long-term research trends or strategies and thesis studies comprise the largest number of entries.

It is inevitable that educational research, being as it is in the service of public educational planning and policy as well as scholarship, will continue to generate a great deal of heated controversy, but it is to be hoped that it can increase the amount of light shed upon these public debates. Some reviewers like Dunkin and Biddle (1974) and Brophy and Evertson (1976) are optimistic, while others like Rosenshine and Furst (1973) are more sober in their conclusions:

> It is possible that the patterns of effective teaching for different ends are so idiosyncratic that they will never be isolated; it is possible that studying teaching in natural settings is unproductive because the settings are not functional for the desired outcomes; it is possible that descriptive systems and research within the descriptive--correlational--experimental loop will be unproductive. At the moment, there has not been enough research to make any firm statement about any of these concerns (p.175).

Perhaps Balzer et al (1973) should have the final words:

> If the picture we obtain from the data is confusing and ambiguous, then our attempts to explain it must be correspondingly ingenious and creative. It is foolish to give up because an immediate payoff is not

evident. Surely if the scientific enterprise means anything in the educational context, it does not mean quick returns in research-based platitudes but a procedure for coming to understand the genuine mysteries that confront us, and the nature of teaching is just such a mystery (p.16).

BIBLIOGRAPHY

Allen, D. I. Student performance, attitude and self-esteem in open area and self contained classrooms. Alberta Journal of Educational Research, March, 1974, 20 (1), 1-7.

Allen, D. I. Conceptual level and program openness: Some data on matching models. Canadian Journal of Education, 1977, 2 (4), 55-64.

Anderson, E. J. et al. Behavioral objectives, science processes, and learning from inquiry-oriented instructional materials. Science Education, 1975, 59 (2), 263-271.

Anderson, G. J., & Walberg, H. J. Classroom climate and group learning. Educational Sciences - An International Journal, September, 1968, 2 (3), 175-80.

Anderson, G. J., & Walberg, H. J. Class size and the social environment of learning: A replication. Alberta Journal of Education Research, December, 1972, 18 (4), 277-286.

Anderson, G. J., & Walberg, H. J. Learning environments. In H. J. Walberg, (Ed.), Evaluating education. Berkeley: McCutchan Publishing Co., 1974.

Anderson, L. M., Evertson, C. M., & Brophy, J. E. Consistency of behavior of some students observed in junior high math and English classes. Paper presented at the annual meeting of the A.E.R.A., April, 1977. (Mimeo)

Averch, H. A. et al. How effective is schooling? Englewood Cliffs, N.J.: Educational Technology Publications (The Rand Corporation) 1974.

Beller, E. K. The evaluation of effects of early educational intervention on intellectual and social development of lower-class disadvantaged children. In E. Grotberg (Ed.), Critical issues in research related to disadvantaged children. Princeton: Educational Testing Service, 1969.

Bennett, N. et al. Teaching styles and pupil progress. Cambridge, Mass.: Harvard University Press, 1976.

Berliner, D. The California beginning teacher evaluation study. Overview of the ethnographic study. Journal of Teacher Education, 1976, 27, 24-30.

Block, J. H. (Ed.) Mastery learning: theory and practice. New York: Holt, Rinehart and Winston, Inc., 1971.

Block, J. H. Teachers, teaching and mastery learning. Today's Education, November-December, 1973, 63 (7), 30-36.

Block, J. H. (Ed.) Schools, society and mastery learning. New York: Holt, Rinehart and Winston, Inc., 1974.

Bloom, B. S. Time and learning. American Psychologist, September, 1974, 29 (9), 682-688.

Bloom, B. S. Human characteristics and school learning. New York: McGraw Hill Book Co., 1976.

Boak, R. T. R., & Conklin, R. C. The effect of teachers' levels of interpersonal skills on junior high school students' achievement and anxiety. American Educational Research Journal, 1975, 12 (4), 537-43.

Bond, J. B., Jr. Change in anxiety level as a factor in test performance. Alberta Journal of Educational Research, June, 1977, 23, (2), 97-102.

Borich, G. D. et al. Convergent and discriminant validity of five classroom observation systems. Testing the model. The University of Texas at Austin: R & D Centre, 1977. (Mimeo)

Brameld, T. The teacher as artist. McGill Journal of Education, 1973, 8 (1), 53-58.

Bredemeier, M. E. Revisiting Coleman and Rosenthal with growth scores. Education, Winter, 1975, 96 (2), 190-200.

Breuning, S. E. Precision teaching in the high school classroom: A necessary step towards maximizing teacher effectiveness and student performance. American Educational Research Journal, 1978, 15 (1), 125-140.

Briggs, C., & Evanechko, P. O. Inquiry training and elementary language skill development. Alberta Journal of Educational Research, June, 1976, 22 (2), 164-172.

Brookover, W. B. et al. Elementary school social environment and school achievement. East Lansing, Mich.: College of Urban Development, 1973.

Brophy, J. E. Precision teaching in the high school classroom: A commentary. American Educational Research Journal, 1978, 15 (1), 141-143.

Brophy, J. E., & Evertson, C. M. Low inference observational coding measures and teacher effectiveness. ERIC Clearing House, 1973, ED 077 879.

Brophy, J. E., & Evertson, C. M. Learning from teaching: A developmental perspective. Boston: Allyn & Bacon, Inc., 1976.

Brophy, J., & Good, T. Teacher student relationships: Causes and consequences. New York: Holt, Rinehart and Winston, Inc., 1974.

Carroll, J. B. Problems of measurement related to the concept of learning for mastery. In J. H. Block (Ed.) Mastery learning: Theory and practice. New York: Holt, Rinehart and Winston, Inc., 1971.

Charters, W. W. Jr. The social background of teaching. In N. L. Gage (Ed.) Handbook of research on teaching. Chicago: Rand McNally Co., 1963.

Choppin, B., Bossert, S. T., & Rosenshine, B. Review symposium: Teaching styles and pupil progress. American Educational Research Journal, 1978, 15 (1), 158-169.

Chu, G. C., & Schram, W. Learning from television: What the research says. Stanford, Calif.: Institute for Communication Research, 1967.

Cobb, J. A. Relationship of discrete classroom behavior to fourth grade academic achievement. Journal of Educational Psychology, 1972, 63, 74-80.

Coleman, J. et al. Equality of educational opportunity. Washington, D.C.: Superintendent of Documents, U.S. Government Printing Office, 1966.

Combs, A. W. The professional education of teachers. Boston: Allyn and Bacon, 1965.

Coombs, A. G., Jr., & Kessler, R. E. In D. W. Allen & E. Seifman (Eds.) Flexible scheduling by computor. The teacher's handbook. Illinois: Scott, Foresman, 1971.

Crocker, R. K. Teaching strategies project: A progress report. Paper presented at the annual meeting of the C.E.R.A., London, Ontario, June, 1978.

Crocker, R. K., et al. Teacher control, classroom behaviors and pupil performance in elementary science classes. Institute for Educational Research and Development, Memorial University, Newfoundland, 1977.

Cronbach, L. J., & Webb, N. Between-class and within-class effects in a reported attitude and treatment interaction: Re-analysis of a study by G. L. Anderson. Journal of Educational Psychology, 1975, 67 (717), 24.

Davis, O. L. Jr., & Tinsley, D. C. Cognitive objectives revealed by questions asked by social studies student teachers. Peabody Journal of Education, 1967, 45 (1), 21-26.

Della-Piana, G. M., & Endo, G. T. Reading research. In R. M. W. Travers, (Ed.) Second handbook of research on teaching. Chicago: Rand McNally College Publishing Co., 1973.

Dickinson, D. J. But what happens when you take reinforcement away? Psychology in the Schools, 1974, 11 (2), 158-100.

Doyle, W., Hancock, G., & Kifer, E. Teachers' perceptions: Do they make a difference? Journal of the Association for the Study of Perceptions, Fall, 1972, 7, 21-30.

Dreeben, R. The school and work place. In R. M. W. Travers, (Ed.). Second handbook of research on teaching. Chicago: Rand McNally College Publishing Co., 1973.

Dunkin, M. J. Problems in the accumulation of process-product evidence in classroom research. British Journal of Teacher Education, 1976, 2 (2), 175-187.

Dunkin, M. J., & Biddle, B. J. The study of teaching. New York: Holt, Rinehart and Winston, 1974.

Edgar, D. P., Evertson, C. M., & Brophy, J. E. Junior high school subject matter and class section differences in low-inference behavioral coding measures. Paper presented at the annual meeting of the A.E.R.A., April, 1977. (Mimeo)

Eggert, W. Teacher process variables and pupil products. Doctoral dissertation, University of Alberta, 1977.

Eggleston, J. F., Galton, M. J., & Jones, M. E. Processes and products of science teaching. Schools Council Research Studies. London: MacMillan Education, 1976.

Eisner, E. Qualitative intelligence and the act of teaching. In R. T. Hyman (Ed.). Teaching: Vantage points for study. New York: J. B. Lippincott Co., 1968.

Emmer, E. Classroom observation scales. Austin, Texas: Research and Development Centre for Teacher Education, University of Texas at Austin, 1972.

Evertson, C. M., & Brophy, J. E. The Texas junior high school study: An overview of methodology and rationale. Paper presented at the annual meeting of the A.E.R.A., April, 1977. (Mimeo)

Fasano, J. Pupil characteristics and dyadic interaction. Doctoral dissertation, University of Alberta, 1977.

Fedigan, L. Information processing styles, characteristics and verbal behaviors of teacher candidates. Unpublished Ph.D. dissertation, University of Texas at Austin, 1971.

Fedigan, L. Conceptual systems theory and teaching: A research review. Educational Leadership, May, 1973, 30 (8), 765-768.

Field, T. W., & Cropley, A. J. Cognitive style and science achievement. Journal of Research in Science Teaching, 1969, 6 (1), 2-10.

Flanagan, J. C. Student characteristics, elementary and secondary. In R. L. Ebel, (Ed.) Encyclopedia of educational research, 4th Edition (A.E.R.A.). London: Collier-MacMillan Ltd., 1969.

Flanders, N. A. Cooperative Research Monograph No. 12 Teacher influence, pupil attitudes, and achievement. Washington, D.C.: U.S. Dept. of Health, Education and Welfare, 1965.

Flanders, N. A. Analyzing teacher behavior. Reading, Mass.: Addison-Wesley, 1970.

Flanders, N. A., & Simon, A. B. Teacher effectiveness. In R. Ebel (Ed.). Encyclopedia of educational research, 4th Edition, 1969.

Flynn, J. T. Contribution of a non-cognitive variable to geometry achievement using an auto-instructional procedure. Journal of Educational Research, July-August, 1969, 62 (10), 449-452.

Franklyn, G. J. Alienation and achievement among Indian-Metis and non-Indians in the Mackenzie District of the N.W.T. Alberta Journal of Educational Research, June, 1974, 20 (2), 157-169.

Gage, N. L. Desirable behaviors of teachers. Urban Education, 1965, 1, 85-95.

Gage, N. L. A factorially designed experiment on teacher structuring. Journal of Teacher Education, Spring, 1976, 27 (1), 35-8.

Gallagher, J. J. A comparison of individualized and group instruction in science: Effects on third grade pupils. Journal of Research in Science Teaching, 1970, 7 (3), 253-263.

Gay, G. Differential dyadic interactions of black and white teachers with black and white pupils in recently desegregated social studies classrooms: A function of teacher and pupil ethnicity. Washington, D.C.: Office of Education Project No. 2F113, January, 1974.

Getzels, J. W., & Jackson, P. W. The teacher's personality and characteristics. In N. L. Gage, (Ed.) Handbook of research on teaching. Chicago: Rand McNally, (A.E.R.A.), 1963.

Gigliotti, R. J., & Brookover, W. B. The learning environment: A comparison of high and low achieving elementary schools. Urban Education, 1975, 10 (3), 245-261.

Glaser, R., & Cooley, W. W. Instrumentation for teachers and instructional management. In R. M. W. Travers, (Ed.). Second handbook of research on teaching. Chicago: Rand McNally College Publishing Co., 1973.

Good, T. L., & Dembo, M. H. Teacher expectations: Self report data. School Review, February, 1973, 8 (2), 247-53.

Good, T. L., & Grouws, D. A. Teaching effects: A process-product study in fourth grade mathematics classrooms. Journal of Teacher Education, May-June, 1977, 28.

Gray, J. L., & Knief, L. M. The relationship between cognitive style and school achievement. Journal of Experimental Education, Summer, 1975, 43 (4), 67-71.

Greene, M. (Ed.) Existential encounters for teachers. New York: Random House, 1967.

Grieve, T. D., & Davis, J. K. The relationship of cognitive style and method of instruction to performance in ninth grade geography. Journal of Educational Research, November, 1971, 5 (3), 137-41.

Griffiths, A. K., & Crocker, R. K. Achievement in individualized and conventional chemistry courses and its interactions with selected academic and personality variables. Alberta Journal of Educational Research, June, 1976, 22 (2), 97-105.

Groobman, D. E., Forward, J. R., & Peterson, C. Attitudes, self esteem and learning in formal and informal schools. Journal of Educational Psychology, February, 1976, 68 (1), 32-5.

Gunderson, D. V. Research in the teaching of English. English Journal, September, 1971, 60 (6), 792-6.

Harnischfeger, A., & Wiley, D. E. The teaching-learning process in elementary schools: A synoptic view. Curriculum Inquiry, 1976, 6 (1), 5-43.

Harnischfeger, A., & Wiley, D. E. Conceptual issues in models of school learning. Mehr licht! Studies of Educative Processes, Report No. 10 CEMREL, Inc., 1977.

Harnischfeger, A., & Wiley, D. E. Teacher resource allocation: Consequence for pupils. Paper presented at the annual meeting of the American Educational Research Association, March, 1978.

Heath, R. W., & Nielson, M. A. The research basis for performance-based teacher education. Review of Educational Research, 1974, 44 (4), 463-484.

Highet, G. The art of teaching. New York: Knopf Publishing Co., 1956.

House, P. A. Learning environments, academic self-concepts and achievement in mathematics. Journal for Research in Mathematics Education, 1975, 6 (4), 244-252.

Houtz et al. Relationship of problem solving to other cognitive variables. Psychological Reports, October, 1973, 33 (2), 389-390.

Hunkins, F. P. Effects of analysis and evaluation questions on various levels of achievement. Journal of Experimental Education, Winter, 1969, 38, 2.

Hunt, D. E. A conceptual level matching model for coordinating learner characteristics with educational approaches. Interchange, June, 1970.

Hunt, D. E. Person-environment interaction; A challenge found wanting before it was tried. Review of Educational Research, 1975, 45 (2), 209-30.

Hunt, D. E. Review of teaching styles and pupil progress. Interchange, 1976-1977, 7 (4), 39-45.

Hunt, D. E. et al. Student conceptual level and models of teaching: Theoretical and empirical coordination of two models. Interchange, 1974, 5 (3), 19-30.

Hunt, D. E., & Hardt, R. H. The role of conceptual level and program structure in summer Upward Bound programs. Youth Development Center, Syracuse University, 1976. (Mimeo)

Hunt, D. E., & Joyce, B. R. Teacher trainee personality and initial teaching style. American Educational Research Journal, May, 1967, 4:3.

Husen, T. Does more time in school make a difference? Saturday Review, April, 29, 1972.

Jackson, G., & Cosca, C. The inequality of educational opportunity in the southwest: An observational study of ethnically mixed classrooms. American Educational Research Journal, 1974, 11, 219-229.

Jeter, J. Teacher expectancies and teacher classroom behavior. Educational Leadership, April, 1973, 30, 7.

Joyce, B., & Weil, M. Perspectives for reform in teacher education. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1972.

Judd, C. H. Introduction to the scientific study of education. Boston: Ginn and Company, 1918.

Karlin, R. What does research reveal - About reading and the high school student? English Journal, March, 1969, 58 (3), 386-95.

Karweit, N. Quantity of schooling: A major educational factor? Educational Researcher, February, 1976, 5 (2), 15-17.

Keeves, J. P. The home, the school, and achievement in mathematics and science. Science Education, 1975, 59 (4), 439-460.

Kennedy, J. J., & Bush, A. J. Overcoming some impediments to the study of teacher effectiveness. Journal of Teacher Education, Spring, 1976, 27 (1), 14-17.

Kounin, J. Discipline and group management in classrooms. New York: Holt, Rinehart and Winston, 1970.

Krywaniuk, L. W., & Das, J. P. Cognitive strategies in native children: Analysis and intervention. Alberta Journal of Educational Research, December, 1976, 22, No. 4, 271-280.

Lahaderne, H. M. Attitudinal and intellectual correlates of attention: A study of four sixth grade classrooms. Journal of Educational Psychology, 1968, 59, 320-324.

Leith, G. O. M., & Davis, T. N. The influence of social reinforcement on achievement. Educational Research, February, 1969, 11 (2), 132-137.

Macdonald, J., & Clark, D. F. Critical value questions and the analysis of objectives and curricula. In R. M. W. Travers, (Ed.). Second handbook of research on teaching. Chicago: Rand McNally College Publishing Co., 1973.

Mackay, A. Observational studies of teaching a progress report. Paper presented at the annual meeting of the Canadian Educational Research Association, London, Ontario, June, 1978.

Mahen, R. Relationships between students' classroom behaviors and selected context, process, and product variables. Doctoral dissertation, University of Alberta, 1977.

Marjoribanks, K. School attitudes, cognitive ability and academic achievement. Journal of Educational Psychology, 1976, 68 (6), 653-660.

Marland, P. W. A study of teachers' interactive thoughts. Doctoral dissertation, University of Alberta, 1977.

Martin, J. The development and use of classroom observation instruments. Canadian Journal of Education, 1977, 2 (3), 43-54.

Martin, J. Functional analysis of Time series data on teacher-student reciprocal interactions. Paper presented at the annual meeting of the C.E.R.A., University of Western Ontario, June, 1978.

Martin, J., & Auerbach, S. Differential outcome effects in teacher training research as a result of functional versus structural behavioral recording. Alberta Journal of Educational Research, June, 1977, 23 (2), 128-137.

McCann, S. J. H., & Fisher, R. J. The interactive relationships of teacher directiveness and student authoritarianism and dogmatism to grades and satisfaction. Alberta Journal of Educational Research, March, 1977, 23 (1), 71-84.

McDonald, F. J. Report on Phase II of the beginning teacher evaluation study. Journal of Teacher Education, 1976a, 27 (1), 39-42.

McDonald, F. J. The effects of teaching performance on pupil learning. Journal of Teacher Education, 1976b, 27 (4), 317-19.

McEwen, N. The quantification of individual student verbalization in a second language classroom. Alberta Journal of Educational Research, March, 1976, 22 (1), 76-87.

McIntyre, Teaching styles and pupil progress. British Journal of Teacher Education, 1976, 2 (3), 291-297.

McKinney et al. Relationship between classroom behavior and academic achievement. Journal of Educational Psychology, 1975, 67 (2), 198-203.

McLachlan, J. F. C., & Hunt, D. E. Differential effects of discovery learning as a function of conceptual level. Canadian Journal of Behavioral Science, 1973, 5, 152-160.

McLoughlin, W. P. The spawning and spurning of the non-graded school. Kappa Delta Pi Record, December, 1971, 8 (2), 33-35.

Medley, D. M. Early history of research on teacher behavior. In N. L. Flanders and G. Nuthall (Eds.). Classroom behavior of teachers. International Review of Education, 1972, 18, 430-437.

Medley, D. M., & Mitzel, H. E. In N. L. Gage (Ed.) Handbook of research on teaching. Chicago: Rand McNally (A.E.R.A.), 1963.

Metcalf, L. Research on teaching the social studies. In N. L. Gage, (Ed.) Handbook of research on teaching. Chicago: Rand McNally, 1963.

Mill, A. (Ed.) Creativity in teaching: Invitation and instances. Belmont, Calif.: Wordsworth Publishing Co., 1961.

Minter, M. O., Evertson, C. M., & Brophy, J. E. Effects of subject-matter and class section on high-inference behavioral ratings in junior high school. Paper presented at the annual meeting of the American Educational Research Association, April, 1977. (Mimeo)

Mitchell, J. V., Jr. The influence of personality characteristics and school environment on high school grades and attitudes toward school. Measurement and Evaluation in Guidance, 1973, 6 (3), 136-144.

Murphy, P. O., & Brown, M. M. Conceptual level and teaching styles. American Educational Research Journal, 1970, 4, 529-60.

Muttart, D. A study of teacher-pupil interaction as it relates to teacher expectations and selected teacher characteristics. Doctoral dissertation, University of Alberta, 1977.

Nielsen, H. D., & Kirk, D. H. In H. J. Walberg, (Ed.) Evaluating educational performance. Berkeley: McCutchan Publishing Co., 1974.

Noble, G. A study of the relationship between ability, performance, attitudes, inclinations and speed of progress using intrinsic programmed instruction. Programmed Learning Educational Technology, April, 1969, 6 (2), 109-120.

Nuthall, G. Is classroom interaction research worth the effort involved? New Zealand Journal of Educational Studies, 1974, 9, 1-17.

Oberlin, L, & Sanders, L. B. A comparison of the science content knowledge of graduates from Florida's new elementary program and graduates who had their science education in a traditional course. Science Education, 1973, 57 (3), 331-334.

Oliveira, A. L. A comparison of the verbal teaching behaviors of junior high school Mexican-American and Anglo-American teachers of social studies and mathematics with classes of predominantly Spanish-speaking children. Unpublished Ph.D. dissertation. University of Texas at Austin, 1970.

O'Reilly, R. Classroom climate and achievement in secondary school mathematics classes. Alberta Journal of Educational Research, December, 1975, 21 (4), 241-48.

Palardy, J. What teachers believe - What children achieve. Elementary School Journal, 1969, 69, 370-374.

Papalia, A., & Zampogna, J. An experiment in individualized instruction through small group interaction. Foreign Language Annals, March, 1972, 5 (3), 302-306.

Parent, J., Forward, J., Canter, R., & Mohling, J. Interactive effects of teaching strategy and personal locus of control on student performance and satisfaction. Journal of Educational Psychology, December, 1975, 67 (6), 704-9.

Peterson, L. T., & McBrayer, J. A strategy to help teachers make a difference: A diagnostic-prescriptive teaching model. Journal of Teacher Education, Summer, 1976, 27 (2), 151-5.

Quarter, J. Participant observation as a method for investigating classroom processes: The case of the teacher expectancy phenomena. Interchange, 1975, 6 (4), 43-47.

Ripple, F. E., Millman, J., & Glock, M. D. Learner characteristics and instructional mode: A search for disordinal interactions. Journal of Educational Psychology, 1969, 60 (2), 113-120.

Robinson, J. E., & Gray, J. L. Cognitive style as a variable in school learning. Journal of Educational Psychology, October, 1974, 66 (5), 793-9.

Robitaille, D. F. Classroom personality patterns of teachers of secondary mathematics. Alberta Journal of Educational Research, December, 1975, 21 (4), 297-304.

Rodgers, D., Slade, K., & Conry, R. Oral language, reading ability and soci-economic background in three Grade 1 classes. Alberta Journal of Educational Research, December, 1974, 20 (4), 316-326.

Rogers, C. R. Freedom to learn. Columbus, Ohio: Merrill Publishing Co., 1969.

Rogers, V., & Baron, J. Teaching styles and pupil progress. Phi Delta Kappan, 1977, 58 (8), 622-623.

Rosenshine, B. The stability of teacher effects upon student achievement. Review of Educational Research, 1970a, 40, 647-662.

Rosenshine, B. Enthusiastic teaching: A research review. School Review, 1970b, 78 (4), 499-514.

Rosenshine, B. Recent research on teaching behaviors and student achievement. Part of this paper was later published in Journal of Teacher Education, February, 1976, 27 61-64. (Mimeo)

Rosenshine, B., & Furst, N. Current and future research on teacher performance criteria. In B. O. Smith (Ed.). Research on teacher education: A symposium. Englewood Cliffs, N.J.: Prentice Hall, 1971.

Rosenshine, B., & Furst, N. The use of direct observation to study teaching. In R. M. W. Travers (Ed.). Second handbook of research on teaching. Chicago: Rand McNally College Publishing Co., 1973.

Rosenthal, R. The Pygmalion effect lives. Psychology Today, September, 1973, 7 (4), 56-63.

Rosenthal, R., & Jacobson, L. Pygmalion in the classroom: Teacher expectations and pupils' intellectual development. New York: Holt, Rinehart and Winston, 1968.

Samuels, S. J., & Turnure, J. E. Attention and reading achievement in first grade boys and girls. Journal of Educational Psychology, 1974, 66, 29-32.

Satterly, D. J. Cognitive styles, spatial ability and school achievement. Journal of Education Psychology, February, 1976, 68 (1), 36-42.

Sayavedra, L. Teacher differential expectations and interaction with Mexican American and Anglo-American secondary physical science students. (Doctoral dissertation, University of Texas) Ann Arbor, Michigan: University Microfilms, 1976, Order No. 77-3978.

Schutz, R. E. The control of "error" in educational experimentation. School Review, 1966, 74, 150-158.

Simon, A., & Boyer, E. (Eds.) Mirrors for behavior: An anthology of observation instruments. Philadelphia: Research for Better Schools Inc., 1967.

Sinks, T. A. How individualized instruction in junior high school science, mathematics, language arts and social studies affects student achievement. Illinois School Research, May, 1969, 5 (3), 5-12.

Sloan, D. Historiography and the history of education. In F. N. Kerlinger (Ed.). Review of research in education. Itaska, Illinois: A.E.R.A., Peacock Publishers, Inc., 1973.

Small, J. M. Administering the open-area elementary school. Canadian Administrator, December, 1975, 15 (3), 1-5.

Soar, R. S. Optimum teacher-pupil interaction for pupil growth. Educational Leadership, 1968, 16, 275-280.

Soar, R. S. Follow through classroom process measurement and pupil growth. Gainsville, Florida: University of Florida, 1970.

Soar, R. S. Teacher behavior related to pupil growth. In N. L. Flanders and G. Nuthall (Eds.). International Review of Education, 18, The Hague: UNESCO, 1972.

Soar, R. S. Final report: Follow through classroom process measurement and pupil growth. (1970-71). Gainsville, Florida: College of Education, University of Florida, 1973.

Spaulding R. ., & Papageorgiou, M. R. Observation of the coping behavior of children in elementary schools, 1975. (Mimeo)

Stallings, J. A., & Kaskowitz, D. H. A study of follow through implementation. Paper presented to the annual meeting of the A.E.R.A., April, 1975. (Mimeo)

Stanton, H. E. Teaching methods and student personality - The search for an elusive interaction. Instructional Science, January, 1974, 2 (4), 477-501.

Stern, G. G. Measuring non-cognitive variables in research on teaching in N. L. Gage, (Ed.). Handbook of research on teaching. Chicago: Rand McNally (A.E.R.A.) 1963.

Stillwell, C. et al. Effects of provision for individual differences and teacher attention upon study behavior and assignments completed. Child Study Journal, 1972, 2 (2), 75-81.

Sullivan et al. The relative effectiveness of instructional television. Interchange, 1976-1977, 7 (1), 46-51.

Therrien, S. Teachers' attributions of student ability. Alberta Journal of Educational Research, September, 1976, 22 (3), 205-215.

Thomas, B., & Snider, B. Effects of instructional method upon the acquisition of inquiry skills. Journal of Research into Science Teaching, 1969, 6 (4), 377-386.

Tisher, R. P. Association between classroom behavior and pupils' understandings: An application of the Smith and Mieux technique. Classroom Interaction Newsletter, 1971, 7 (1), 30-39.

Tobias, S., & Ingber, T. Achievement - treatment interactions in programmed instruction. Journal of Educational Psychology, February, 1976, 68 (1), 43-47.

Tomlinson, P. O., & Hunt, D. E. The differential effectiveness of three teaching strategies for students of high and low conceptual levels. Paper presented at the annual meeting of the A.E.R.A., 1970. (Mimeo)

Travers, R. M. W. Education technology and related research viewed as a political force. In R. M. W. Travers (Ed.) Second handbook of research on teaching. Chicago: Rand McNally College Publishing Co., 1973.

Traub, et al. Closure on openness: Describing and quantifying open education. Interchange, 1972, 3 (2), 3, 69-84.

Tukeman, B. W., & Orefice, D. S. Personality structure, instructional outcomes, and instructional preferences. Interchange, 1973, 4 (1), 43-48.

Walberg, H. J. Models for optimizing and individualizing school learning. Interchange, 1971, 2 (3), 15-27.

Walberg, H. J. Educational process evaluation. In Apple et al. (Eds.). Educational evaluation analysis and responsibility. Berkeley, Calif.: McCutchan Publishing Co., 1974.

Walberg, H. J. (Ed.) Evaluating educational performance. Berkeley, Calif.: McCutchan Publishing Co., 1974.

Wallen, N. E., & Travers, R. M. W. Analysis and investigation of teaching methods in N. L. Gage (Ed.). Handbook of research on teaching. Chicago: Rand McNally (A.E.R.A.) 1963.

Walters, L., & Sieben, G. Cognitive style and learning science in elementary schools. Science Education, January/March, 1974, 58 (1), 65-74.

Wang, M. C. The accuracy of teachers' predictions on childrens' learning performance. Journal of Educational Research, July-August, 1973, 66 (10), 462-65.

Webb, D. Teacher sensitivity: Affective impact on students. Journal of Teacher Education, Winter, 1971, 22 (4), 455-59.

Wideen, M. F. Comparison of student outcomes for science - A process approach and traditional science teaching for third, fourth, fifth and sixth grade classes: A product evaluation. Journal of Research in Science Teaching, 1975, 12 (1), 31-39.

Wideen, M. F., Kennedy, B. J., & Bettschen, C. The identification of teacher process variables affecting student outcomes on two alternative science curriculum treatment settings, 1977. (Mimeo)

Williams, J. D. et al. Creativity, dogmatism and arithmetic achievement. Journal of Psychology, July, 1971, 78, 217-222.

Williams, T. Teacher prophecies and the inheritance of inequality. Sociology of Education, July, 1976, 49 (3), 223-36.

Winnie, P. H., & Marx, R. W. Reconceptualizing research on teaching. Journal of Educational Psychology, 1977, 69 (6), 668-678.

Withall, J., & Lewis, W. W. Social interaction in the classroom. In N. L. Gage (Ed.). Handbook of research on teaching. Chicago: Rand McNally, 1963.

Wragg, E. C. The Lancaster study: Its implications for teacher training. British Journal of Teacher Education, 1976, 2 (3), 281-290.

Wright, C. J., & Nuthall, G. Relationships between teacher behaviors and pupil achievement in three experimental elementary science lessons. American Educational Research Journal, 1970, 7 (4), 477-91.

Wright, R. J. The affective and cognitive consequences of an open education elementary school. American Educational Research Journal, 1975, 12 (4), 449-468.

Yeatts, P. P., & Strag, G. A. Flexibility of cognitive style and its relationship to academic achievement in fourth and sixth grades. Journal of Educational Research, April, 1971, 64 (8), 345-346.